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VAPORIZATION OF ALKALI METAL OXIDES, by Leo Brewer and John Margrave. July 1, 1952. 25p. (UCRL-1864)

UCRL-1871 56
Radiation Lab., Univ. of Calif., Berkeley
THE PATH OF CARBON IN PHOTOSYNTHESIS. XVII. PHOSPHORUS COMPOUNDS AS INTERMEDIATES IN PHOTOSYNTHESIS, by J. G. Buchanan, J. A. Bassham, A. A. Benson, D. F. Bradley, M. Calvin, L. L. Daus, M. Goodman, P. M. Hayes, V. H. Lynch, L. T. Norris, and A. T. Wilson. July 8, 1952. 32p. (UCRL-1871)

UCRL-1913(rev.) 350
Radiation Lab., Univ. of Calif., Berkeley
HIGH ENERGY PHOTOPROTON PRODUCTION BY 322 MEV BREMSSTRAHLUNG, by J. W. Rosengren and J. M. Dudley. Oct. 13, 1952. 16p. (UCRL-1913(rev.))

UCRL-1922 18
Radiation Lab., Univ. of Calif., Berkeley
MEDICAL AND HEALTH PHYSICS QUARTERLY REPORT [FOR] APRIL, MAY, AND JUNE, 1952. Aug. 21, 1952. 84p. (UCRL-1922)

UCRL-1922(p.2-38) 19
Radiation Lab., Univ. of Calif., Berkeley
THE METABOLIC PROPERTIES OF VARIOUS MATERIALS, p.2-38 of MEDICAL AND HEALTH PHYSICS QUARTERLY REPORT [FOR] APRIL, MAY, AND JUNE, 1952. Aug. 21, 1952. 37p. (UCRL-1922(p.2-38))

UCRL-1922(p.40-80) 20
Radiation Lab., Univ. of Calif., Berkeley
BIOLOGICAL STUDIES OF RADIATION EFFECTS, p.40-80 of MEDICAL AND HEALTH PHYSICS QUARTERLY REPORT [FOR] APRIL, MAY, AND JUNE, 1952. Aug. 21, 1952. 41p. (UCRL-1922(p.40-80))

UCRL-1931 108
Radiation Lab., Univ. of Calif., Berkeley
THE THERMODYNAMICS OF THE RARE EARTH OXIDES, by Leo Brewer. Sept. 1952. 6p. (UCRL-1931)

UCRL-1940 272
Radiation Lab., Univ. of Calif., Berkeley
THE RATIO OF POSITIVE TO NEGATIVE MESON PRODUCTION FROM DEUTERIUM, by J. Carothers and C. G. Andrè. Sept. 16, 1952. 6p. (UCRL-1940)

UCRL-1946 57
Radiation Lab., Univ. of Calif., Berkeley
THE PATH OF CARBON IN PHOTOSYNTHESIS. XIX. THE IDENTIFICATION OF SUCROSE PHOSPHATE IN SUGAR BEET LEAVES, by J. G. Buchanan. Sept. 1952. 15p. (UCRL-1946)

UCRL-1947 173
Radiation Lab., Univ. of Calif., Berkeley
RESONANT CAVITY FIELD MEASUREMENTS, by S. W. Kitchen and A. D. Schelberg. Sept. 11, 1952. 24p. (UCRL-1947)

UCRL-1948 174
Radiation Lab., Univ. of Calif., Berkeley
PHYSICS DIVISION QUARTERLY REPORT [FOR] MAY, JUNE, AND JULY 1952. Sept. 16, 1952. 21p. (UCRL-1948)

UCRL-1951 340
Radiation Lab., Univ. of Calif., Berkeley
BIBLIOGRAPHY OF PARTICLE ACCELERATORS [FOR] JANUARY TO DECEMBER 1951, by Sergey Shewchuck. Sept. 1952. 45p. (UCRL-1951)

UCRL-1955 41
Radiation Lab., Univ. of Calif., Berkeley
SPECIAL EQUIPMENT FOR THE CARBON-14 LABORATORY, by B. M. Tolbert, N. Garden, and P. T. Adams. Sept. 29, 1952. 10p. (UCRL-1955)

UCRL-1956 58
Radiation Lab., Univ. of Calif., Berkeley
PHOSPHORUS AND PHOTOSYNTHESIS. I. DIFFERENCES IN THE LIGHT AND DARK INCORPORATION OF RADIOPHOSPHATE, by M. Goodman, D. F. Bradley, and M. Calvin. Oct. 1952. 25p. (UCRL-1956)

UCRL-1960 351
Radiation Lab., Univ. of Calif., Berkeley
ELECTRON-POSITRON ANNIHILATION IN FLIGHT, by S. A. Colgate and F. C. Gilbert. Oct. 7, 1952. 12p. (UCRL-1960)

UCRL-1963 273
Radiation Lab., Univ. of Calif., Berkeley
ON THE PLUS-MINUS RATIO FROM PROTON BOMBARDMENT OF DEUTERIUM, by Malvin A. Ruderman. Oct. 2, 1952. 4p. (UCRL-1963)

UCRL-1966 59
Radiation Lab., Univ. of Calif., Berkeley
CO_2 FIXATION BY EUGLENA, by V. H. Lynch and M. Calvin. Oct. 13, 1952. 22p. (UCRL-1966)

UCRL-1992 274
Radiation Lab., Univ. of Calif., Berkeley
SUMMARY OF RESEARCH PROGRESS MEETING OF OCTOBER 2 AND OCTOBER 9, 1952, by Sergey Shewchuck. Oct. 22, 1952. 7p. (UCRL-1992)

UR-154(rev.) 92
Atomic Energy Project, Univ. of Rochester
A BIBLIOGRAPHY OF THE LITERATURE (1936-1952) ON THE PHARMACOLOGY AND TOXICOLOGY OF FLUORINE AND ITS COMPOUNDS, INCLUDING EFFECTS ON BONES AND TEETH, by Frank A. Smith and G. J. Cox. Sept. 26, 1952. 186p. (UR-154(rev.))

UR-201(pt.I) 21
Atomic Energy Project, Univ. of Rochester
HISTOPATHOLOGY OF ALPHA RADIATION FROM INTERNALLY ADMINISTERED POLONIUM, by George W. Casarett. Aug. 25, 1952. 267p. (UR-201(pt.I))

UR-201(pt.II) 22
Atomic Energy Project, Univ. of Rochester
HISTOPATHOLOGY OF ALPHA RADIATION FROM INTERNALLY ADMINISTERED POLONIUM, by George W. Casarett. Aug. 25, 1952. 563p. (UR-201(pt.II))

UR-216 60
Atomic Energy Project, Univ. of Rochester
THE RELATION OF PROTEIN SYNTHESIS TO NUCLEIC ACID PHOSPHORUS TURNOVER IN THE RAT LIVER, by Doris R. Frankel. Sept. 10, 1952. 59p. (UR-216)

UR-218 23
Atomic Energy Project, Univ. of Rochester
X-IRRADIATION INJURY AND REPAIR IN THE GERMINAL EPITHELIUM OF MALE RATS. I. INJURY AND REPAIR IN ADULT RATS, by Samuel Lelus Shaver. Sept. 23, 1952. 47p. (UR-218)

UR-219 24
Atomic Energy Project, Univ. of Rochester
X-IRRADIATION INJURY AND REPAIR IN THE GERMINAL EPITHELIUM OF MALE RATS. II. INJURY AND REPAIR IN IMMATURE RATS, by Samuel Lelus Shaver. Sept. 23, 1952. 20p. (UR-219)

Y-919 79
Carbide and Carbon Chemicals Co. (Y-12)
DETERMINATION OF AMMONIA AND NITRATE NITROGEN PRESENT IN URANYL SULFATE AND URANIUM OXIDES, by W. B. Wright, Jr. Nov. 23, 1951. 20p. (Y-919)

OTHER UNCLASSIFIED REPORTS OF SPECIAL INTEREST TO AEC LABORATORIES

AERE-C/M-152 100
Atomic Energy Research Establishment, Harwell, Berks (England)
A SIMPLE AIR EJECTOR AS A SUCTION MOTOR FOR DRY BOXES, by J. R. Catlin, L. Coward, D. Darling, W. T. Spragg, and C. G. Webb, and APPENDIX: A DESIGN FOR THE MANUFACTURE OF AN AIR EJECTOR FROM STANDARD COPPER ALLOY PIPE FITTINGS FOR OBTAINING REDUCED PRESSURE IN DRY BOXES, by P. G. Reynolds. 1952. 12p. (AERE-C/M-152)

AERE-Inf/Bib-83 212
Atomic Energy Research Establishment, Harwell, Berks (England)
DRYING OF GASES AND DETERMINATION OF MOISTURE IN GASES; A SELECTED BIBLIOGRAPHY OF LITERATURE REFERENCES. 1951. 6p. (AERE-Inf/Bib-83)

AERE M/R-893 136
Atomic Energy Research Establishment, Harwell, Berks (England)
PRACTICAL AND THEORETICAL ASPECTS OF THE HOT PRESSING OF REFRACTORY OXIDES, by P. Murray, E. P. Rodgers, and A. E. Williams. July 30, 1952. 37p. (AERE M/R-893)

AERE T/R-917 299
Atomic Energy Research Establishment, Harwell, Berks (England)
STUDIES IN jj-COUPLING. III. NUCLEAR ENERGY LEVELS, by B. H. Flowers and A. R. Edmonds. May 1952. 17p. (AERE T/R-917)

AERE T/R-963 300
Atomic Energy Research Establishment, Harwell, Berks (England)
STUDIES IN jj-COUPLING. IV. THE $g_{9/2}$-SHELL, by B. H. Flowers. June 1952. 8p. (AERE T/R-963)

AERE T/R-983 345
Atomic Energy Research Establishment, Harwell, Berks (England)
THE THEORY OF THE DOUBLE COMPTON EFFECT, by F. Mandl and T. H. R. Skyrme. 1952. 17p. (AERE T/R-983)

AMRL-77 39
Army Medical Research Lab., Fort Knox
TETRAZOLIUM SALTS AS PROTECTORS AGAINST LETHAL EFFECTS OF X-RAYS, by N. Puckett, S. Bellack, and A. T. Krebs. Mar. 5, 1952. 9p. (AMRL-77)

GS-C-186 142
Geological Survey
PITCHBLENDE DEPOSITS AT THE WOOD AND CALHOUN MINES, CENTRAL CITY MINING DISTRICT, GILPIN COUNTY, COLORADO, by F. B. Moore and C. R. Butler. 1952. 8p., 3 illus. (GS-C-186)

GS-C-189 143
Geological Survey
URANIUM OCCURRENCES ON MERRY WIDOW CLAIM, WHITE SIGNAL DISTRICT, GRANT COUNTY, NEW MEXICO, by Harry C. Granger and Herman L. Bauer, Jr. 1952. 16p., 2 illus. (GS-C-189)

GS-C-195 144
Geological Survey
RADIOACTIVITY OF SELECTED ROCKS AND PLACER CONCENTRATES FROM NORTHEASTERN ALASKA, by Max G. White. 1952. 12p. (GS-C-195)

NBS-1624 137
National Bureau of Standards
INTERIM REPORT ON EVALUATION OF TESTS FOR CERMETS AS COMPONENTS OF HEAT-RESISTANT MATERIALS, by G. B. Massengale, L. E. Mong, M. B. Stiefel, and R. A. Heindl. Apr. 25, 1952. 124p. (NBS-1624)

NBS-1919 347
National Bureau of Standards
DEGRADATION AND RANGE STRAGGLING OF HIGH ENERGY RADIATIONS, by U. Fano. Sept. 15, 1952. 82p. (NBS-1919)

NBS-1955 348
National Bureau of Standards
CALCULATION OF PEAKED ANGULAR DISTRIBUTIONS FROM LEGENDRE POLYNOMIAL EXPANSIONS AND AN APPLICATION TO THE MULTIPLE SCATTERING OF CHARGED PARTICLES, by L. V. Spencer. Sept. 25, 1952. 19p. (NBS-1955)

NGF-T-29-52 154
Naval Gun Factory
COARSENABILITY OF THE ALUMINUM-COPPER AND ALUMINUM-SILICON CASTING ALLOYS, by Harold Bernstein. July 17, 1952. 15p. (NGF-T-29-52; U-23914)

NP-4074 155
Watertown Arsenal Lab.
NUCLEONICS APPLICATIONS; METALLURGICAL APPLICATIONS OF AUTORADIOGRAPHY. I. A LITERATURE SURVEY. II. PRELIMINARY EXPERIMENTS, by Samuel Millman and Laurence S. Foster. Jan. 2, 1952. 35p. (NP-4074; WAL-843/8)

NP-4084 243
Material Lab., New York Naval Shipyard
FINAL REPORT ON INVESTIGATION OF PULSES FROM GEIGER-MUELLER TUBES OPERATED UNDER MINIMUM LOADING CONDITIONS USING STATISTICAL TECHNIQUES, by W. G. Egan and G. E. Davis. Apr. 10, 1952. 31p. (NP-4084)

NP-4089 156
Armour Research Foundation
INTERIM TECHNICAL REPORT NO. 2 [ON] SURFACE HARDENING OF TITANIUM WITH METALLOID ELEMENTS [FOR] DECEMBER 1, 1951 TO MAY 31, 1952, by R. W. Hanzel and Verne Pulsifer. [nd] 41p. (NP-4089; WAL-401/13; Interim Technical Report No. 2)

NP-4112 128
Massachusetts Inst. of Tech. Div. of Industrial Cooperation
TECHNICAL REPORT NO. 4 [ON] LOCAL BOILING HEAT TRANSFER TO WATER AT LOW REYNOLDS NUMBERS AND HIGH PRESSURES, by J. A. Clark and W. M. Rohsenow. July 1, 1952. 59p. (NP-4112; DIC-6627)

NP-4113 269
Cosmic Ray Lab., Univ. of Puerto Rico
TECHNICAL REPORT NO. 1 ON RANGE DISTRIBUTION OF SEA LEVEL MESONS AT LOW GEOMAGNETIC LATITUDES, by L. del Rosario and J. Dávila-Aponte. June 15, 1952. 18p. (NP-4113; Bull. No. 4; Technical Report No. 1; U-23782)

NP-4116 221
Columbia Radiation Lab., Columbia Univ.
THE SECOND QUARTERLY REPORT FOR THE YEAR 1952 TO THE SIGNAL CORPS SCIENTIFIC REPRESENTATIVE. June 30, 1952. 20p. (NP-4116; U24101)

NP-4117 222
Columbia Radiation Lab., Columbia Univ.
THE FIRST QUARTERLY REPORT FOR THE YEAR 1952 TO THE SIGNAL CORPS SCIENTIFIC REPRESENTATIVE. Mar. 31, 1952. 28p. (NP-4117; U-22662)

NP-4120 16
Naval Medical Research Inst., Bethesda
THE USE OF SMALL LABORATORY ANIMALS IN MEDICAL RADIATION BIOLOGY. PART I. APPLICATION OF A 200 K.V.P. X-RAY THERAPY UNIT TO LETHAL DOSE STUDIES, by Friedrich Ellinger, Jasper E. Morgan, and Francis W. Chambers, Jr. Apr. 30, 1952. 35p. (NP-4120; U23980)

NP-4123 301
Research Lab. of Electronics, Mass. Inst. of Tech.
THE MAGNETIC MOMENT AND HYPERFINE STRUCTURE ANOMALY OF K^{40}, by Joseph T. Eisinger and Benjamin Bederson. Jan. 28, 1952. 32p. (NP-4123; Technical Report No. 212; U24409)

NP-4125 223
Baird Associates, Inc.
TECHNICAL REPORT COVERING THE PERIOD JUNE 1950 TO SEPTEMBER 1952 [ON PROBLEM OF FIXED FILTER DEVELOPMENT FOR TUNING PURPOSES], by Bruce H. Billings, Stanley J. Sage and Norman Hapgood, Jr. [nd] 90p. (NP-4125; U24400)

NP-4182 78
Department of Mines and Technical Surveys, Mines Branch, Ottawa (Canada)
THE DETERMINATION OF ALUMINUM; FLUOROPHOTO-

METRIC METHOD, by J. B. Zimmerman. Oct. 21, 1952. 11p. (NP-4182; TR-104/52)

PR-P-15-E 244
Chalk River Project (Canada)
PROGRESS REPORT [FOR] MAY 16, 1952 – SEPTEMBER 30, 1952; ELECTRONICS BRANCH, by J. Hardwick. [nd] 20p. (PR-P-15-E)

RCC/R-26 245
Radiochemical Center, Amersham, Bucks (England)
THE MEASUREMENT OF MICRO-MICROCURIE AMOUNTS OF RADON BY A SCINTILLATION COUNTING METHOD, by J. Bryant and M. Michaelis. Sept. 10, 1951. 26p. (RCC/R-26)

TEI-263 145
Geological Survey
THE PERMIAN PHOSPHORITE DEPOSITS OF WESTERN UNITED STATES, by V. E. McKelvey, R. W. Swanson, and R. P. Sheldon. Oct. 1952. 30p. (TEI-263)

TEI-265 146
Geological Survey
THE GEOLOGY OF THE FLORIDA LAND-PEBBLE PHOSPHATE DEPOSITS, by J. B. Cathcart, L. V. Blade, D. F. Davidson, and K. B. Ketner. Sept. 1952. 21p. (TEI-265)

TEI-267 114
Geological Survey
THE EFFECT OF ASHING TEMPERATURES ON THE VOLATILITY OF GERMANIUM IN LIGNITE SAMPLES, by Wendell P. Tucker and Claude L. Waring. Sept. 1952. 8p. (TEI-267)

U-15729 198
Evans Signal Lab., Signal Corps Engineering Labs.
A "HIGH VACUUM" COLD CATHODE GASEOUS DISCHARGE. A CYCLOTRON EFFECT (thesis), by Israel R. Senitzky. Sept. 1, 1950. 40p. (U-15729)

U-18056 138*
New Jersey Ceramic Research Station, Rutgers Univ.
HIGH THERMAL SHOCK CERAMICS; PART II OF QUARTERLY PROGRESS REPORT NO. 1 [FOR] DECEMBER, 1950–MARCH 1, 1951, TIP U18054. 1951. 18p. (U-18056)

U-18954 182
Denver Univ.
QUARTERLY PROGRESS REPORT [ON] CORRELATION OF METEOROLOGICAL PARAMETERS WITH COSMIC RAY DATA [FOR PERIOD] JANUARY 1–MARCH 31, 1951, by Mario Iona, Jr. Mar. 31, 1951. 25p. (U-18954; Report No. 8)

U-18992 139*
New Jersey Ceramic Research Station, Rutgers Univ.
DEVELOPMENT OF CERAMIC BODIES WITH HIGH THERMAL CONDUCTIVITY; PART I OF QUARTERLY PROGRESS REPORT NO. 2, TIP U18991. [1951] 23p. (U-18992)

U-19071 197
Carnegie Inst. of Tech.
THE STUDY OF PLASTIC DEFORMATION IN AN ORDERED Cu_3Au SINGLE CRYSTAL BY X-RAY MEASUREMENTS (thesis), by C. Eugene Dixon. Aug. 10, 1951. 103p. (U-19071)

USNRDL-364 246
Naval Radiological Defense Lab.
EVALUATION OF THE AN/PDR-37 (XN-1) RADIAC METER, by G. A. Work and C. E. Parker. Aug. 18, 1952. 20p. (USNRDL-364)

NUCLEAR SCIENCE ABSTRACTS

Vol. 7 January 15, 1953 No. 1

BIOLOGY AND MEDICINE

1
Cancer Research Inst., New England Deaconess Hospital, Boston
FACTORS FAVORING PHAGOCYTOSIS BY RETICULO-ENDOTHELIAL CELLS EARLY IN INFLAMMATION, by Edna H. Tompkins and Mary A. Grillo. [nd] 24p. (AECU-2280)

Factors affecting phagocytosis by the so-called resting-wandering cells of reticulo-endothelial tissues in the early stages of inflammation were studied both in vivo and in vitro. Conversion of these cells into macrophages in preparation for phagocytosis is described. It was shown that these cells carry the burden of phagocytosis in the first twelve hours of inflammation and also share in phagocytosis after the arrival of polymorphonuclear cells. (C.R.)

2
Argonne National Lab.
CUMULATIVE INDEX FOR QUARTERLY REPORTS OF THE DIVISION OF BIOLOGICAL AND MEDICAL RESEARCH FOR AUGUST 1949 – JANUARY 1952, by Antreen M. Pfau, Helen C. Supert, and Austin M. Brues. [nd] 45p. (ANL-4894)

3
BIOLOGICAL STUDIES ON STABLE AND RADIOACTIVE RARE EARTH COMPOUNDS. I. ON THE DISTRIBUTION OF LANTHANUM IN THE MAMMALIAN ORGANISM. Daniel Laszlo, Daniel M. Ekstein, Ruth Lewin, and Kurt G. Stern. J. Natl. Cancer Inst. 13, 559-73(1952) Oct.

The distribution of La in normal and tumor-bearing mice was studied as a function of time, dose, route of administration, and chemical state of the element. La chloride, injected intravenously, is taken up rapidly by various tissues and the concentration was found to be highest in liver and spleen, and low in the skeletal system. The concentration in the lung was very low until a critical dose-level was reached, whereupon it rose sharply. Minimal transport occurred when La chloride was injected intraperitoneally or subcutaneously. This suggests its intracavitary or intratumoral use. La complexes are distributed more homogeneously than the ionized forms. The implications for therapy of tumors with rare-earth radioisotopes are discussed. (auth)

4
MODIFIED ELECTROPHORESIS CELL FOR DETERMINATION OF LABELED PHOSPHOPROTEINS. R. E. Hein and R. E. Clegg. Nucleonics 10, No. 10, 70-1(1952) Oct.

Serum prepared from the centrifugation of the blood clot of chickens fed radioactive phosphate, was found to contain over 95% phosphoproteins. The P^{32} activity was measured by modifying the center cell of a Tiseleus electrophoretic apparatus, grinding out the ascending arm so that only 0.9 mm thickness of glass would intervene between the mounted counter tube and serum fraction. β particles of energies as low as 0.7 Mev could then be measured. (L.M.T.)

RADIATION EFFECTS

5
Chicago Univ.
HISTOCHEMICAL STUDIES ON THE LENS FOLLOWING RADIATION INJURY, by Solbert Permutt and Frank B. Johnson. [nd] 29p. (AECU-2278)

Studies are reported on the effects of x and slow-neutron irradiation on depolymerization of the polysaccharide–protein components of the lens in rabbits. Selective staining and enzyme techniques were employed for the histochemical localization of polysaccharide–protein complexes in frozen-dried specimens. Changes in the lenses observed by opthalmoscopic examination of irradiated rabbits shortly before their death, and changes observed during histochemical examination of tissue sections are summarized. Damage to the lenses caused by slow-neutron radiation appeared much more marked than the damage caused by x irradiation. Changes are interpreted as resulting from a depolymerization of the polysaccharide–protein complexes of the lens. The relation between the observed depolymerization and the pathogenesis of radiation cataracts is discussed. (C.R.)

6
Argonne National Lab.
DIVISION OF BIOLOGICAL AND MEDICAL RESEARCH QUARTERLY REPORT [FOR] FEBRUARY, MARCH, APRIL, 1952, by Austin M. Brues, ed. [nd] 175p. (ANL-4794)

Separate abstracts have been prepared on six sections of this report.

7
Argonne National Lab.
CHRONIC EXTERNAL IRRADIATION and NEUTRON RADIOBIOLOGY, p.13-32 of DIVISION OF BIOLOGICAL AND MEDICAL RESEARCH QUARTERLY REPORT [FOR] FEBRUARY, MARCH, APRIL, 1952, by Austin M. Brues, ed. [nd] 20p. (ANL-4794(p.13-32))

Guinea pigs given therapeutic injections of bone marrow following 750-r total-body x radiation survived and had normal blood pictures after 40 days, while irradiated control animals all died. Data on bone marrow injections after chronic irradiation reveal a large increase in reticulocytes immediately after injection and the rapid return of the number of circulating red cells and platelets to normal. No gross or histological modifications of irradiation injuries were observed in mice and guinea pigs given injections of Menkin's leukocytosis-promoting factor following total-body irradiation. Tissue cultures showed complete recovery from the effects of 500-r x irradiation after 24 days, while at 750 r from one-third to one-half of the cultures repopulated and at 2000 r none recovered. Rats exposed to 450-r total-body x radiation showed a twofold increase in total N excretion as well as urea N, indicating that protein metabolic processes were markedly affected. Photographs are included of exposure chambers for use in the neutron radiobiology program. (C.R.)

8
Argonne National Lab.
HEMATOLOGY, p.33-51 of DIVISION OF BIOLOGICAL AND MEDICAL RESEARCH QUARTERLY REPORT [FOR] FEBRUARY, MARCH, APRIL, 1952, by Austin M. Brues, ed. [nd] 19p. (ANL-4794(p.33-51))

Preliminary histologic studies of single lead-shielded Peyer's patches in exteriorized segments of the ileum of rabbits exposed to 800-r total-body radiation indicate that response of this area is comparable with that of the lead-

shielded spleen and appendix. Preliminary data indicate that hematologic recovery is more rapid in surviving mice that were spleen-shielded during exposure to 800-r total-body x radiation than in survivors without spleen shielding. It was found that protein deprivation was followed promptly by marked diminution of hemoglobin formation as measured by the incorporation of Fe^{59} into erythrocytes. Equations are presented to facilitate the study of factors which influence the rate of incorporation of tracer quantities of P^{32} into erythrocytes. Results indicate that 500-r total-body x radiation with spleen shielding protects the antibody-forming mechanism in rats after hypophysectomy, while exposure to x rays without spleen protection markedly suppresses the formation of antibodies. Experiments using mice indicate that surgery does not reduce survival following exposure to total-body x radiation in doses well above the LD_{50}, and that the additional stress imposed on the body by surgery may actually enhance survival from radiation damage. Results are reported of a study of the effects of various types of cages and various diets upon the survival of laboratory mice. Results of a dietary study in hamsters indicate that Tween 20 (polyoxyethylene sorbitan monolaurate), which is widely used as a softening or smoothing agent in commercial food preparation, has a marked effect on Fe absorption from the gastrointestinal tract. (C.R.)

9

Argonne National Lab.

PHYSIOLOGY and RADIUM TOXICITY, p.52-65 of DIVISION OF BIOLOGICAL AND MEDICAL RESEARCH QUARTERLY REPORT [FOR] FEBRUARY, MARCH, APRIL, 1952, by Austin M. Brues, ed. [nd] 14p. (ANL-4794(p.52-65))

Data on the effectiveness of cysteine in diminishing biological effects of x irradiation are extended to the protective effects against lymphopenia, granulocytopenia, and splenic involution in mice. Data indicate the protective effect of cysteine is enhanced in mice breathing 10% oxygen for several minutes before and during irradiation and also when the animals are injected prior to exposure with 2,4-dinitrophenol followed by cysteine. The mechanisms of cysteine protection are discussed. Blood data collected in a study of the radiosensitivity of bats are included. The use of combined data on total Ra content and exhaled Rn to estimate the amount of Ra deposited in the lungs of patients following inhalation of $RaSO_4$ dust is discussed. (C.R.)

10

Argonne National Lab.

EXPERIMENTAL CYTOLOGY and EXPERIMENTAL PATHOLOGY and EXPERIMENTAL SURGERY and HISTOPATHOLOGY and RADIOCHEMISTRY and SPECIAL PROBLEMS, p.66-100 of DIVISION OF BIOLOGICAL AND MEDICAL RESEARCH QUARTERLY REPORT [FOR] FEBRUARY, MARCH, APRIL, 1952, by Austin M. Brues, ed. [nd] 35p. (ANL-4794(p.66-100))

Data are presented on the protective effects of intravenously injected dog plasma and dog spleen perfusates prior to exposure of mice to x radiation. Malignant bone changes in mice 600 days after intravenous injection of U^{233} and 400 days after intravenous injection of Ra^{226} or Pu^{239} are summarized. A simple, rapid method is reported for simultaneously determining the total C and the specific activity of C^{14} in small organic samples. Electromicrographs demonstrate that the development of collagen fibrils in the cut ends of the Achilles tendon in rats have an intracellular origin. Calculations were made of the activation of earth or water by slow neutrons, taking into account all of the elements contained therein (except the inert gases and the heaviest elements) on which adequate unclassified data are available. Data on approximate total activity in curies at different times after activation by one mole of neutrons are presented graphically for earth, sea water, and lake water. Epinephrine pretreatment markedly protected irradiated chicks against radiation injury; however, protection was observed only when the dose was large enough to produce symptoms of shock and when the drug was active during irradiation. (C.R.)

11

Argonne National Lab.

INVERTEBRATE ZOOLOGY and PHYTORADIOBIOLOGY and PLANT PHYSIOLOGY and MICROBIOLOGY and BIOCHEMISTRY, p.101-37 of DIVISION OF BIOLOGICAL AND MEDICAL RESEARCH QUARTERLY REPORT [FOR] FEBRUARY, MARCH, APRIL, 1952, by Austin M. Brues, ed. [nd] 37p. (ANL-4794(p.101-37))

A description is presented of the living ovariole of the grasshopper. An extensive motion-picture record of the roto-oscillations of the grasshopper egg nuclei is reported. Energy requirements and possible energy sources for the oscillating nucleus, binucleate cell formation in spermatocytes, and the effects of x irradiation on enzymogenesis in embryos and on P metabolism in eggs of grasshoppers are discussed. Data are included on the radiosensitivity of auxin biosynthesis. The recovery of C^{14}-labeled, low-molecular-weight dextran and its conversion to crystalline glucose following acid hydrolysis are described. Data from studies of the effects of photoperiod, low light intensity interruption of dark periods, number of photoreceptive leaves, number of mature leaves, and auxin treatment on the growth and development of kidney beans are presented in tabular form. Data from a comparison of theoretical and experimental loss in biological action with time of nitrogen mustard in aqueous solution are presented graphically. Studies of the effects of x radiation on paramecium led to the conclusion that reproduction is affected in at least two distinct ways. A transient decrease in growth rate dies away monotonically, while a disturbance of the orderly process of division is manifested in increased variability of growth. (C.R.)

12

Argonne National Lab.

PHYSICAL CHEMISTRY and PHARMACOLOGY and BIOPHYSICS, p.138-65 of DIVISION OF BIOLOGICAL AND MEDICAL RESEARCH QUARTERLY REPORT [FOR] FEBRUARY, MARCH, APRIL, 1952, by Austin M. Brues, ed. [nd] 28p. (ANL-4794(p.138-65))

An investigation was made of the influence of molecular structures on the interaction of reagents with ionized Be. Preliminary data are reported for the therapeutic effects of aurintricarboxylic acid, salicylic acid, and sulfosalicylic acid in induced Be poisoning. Data are included on the effects of total-body x irradiation on the tryptophan peroxidase-oxidase activity of rat liver. A proposal is presented for the evaluation of the relative biological effectiveness of α rays and β rays based on the comparison of radiation effects produced by radioelements emitting either type of radiation, the role played by their volumetric pattern of concentration, and the variation of this pattern with time. Decay data for isotopes considered in the study are presented in tabular form. A possible screening test for radiation damage-inhibiting compounds based on the diminution of light emitted by a scintillation solution when the substance being tested is introduced into the solution is discussed. Preliminary data on reactions of elemental S, cysteine, and cystine are included. Data on the ionization in air of β rays from a point source and data from an evaluation of ionization-type halide detectors are included. (C.R.)

13
Los Alamos Scientific Lab.
THE BIOLOGICAL EFFECTIVENESS OF THERMAL NEUTRONS ON MICE, by James T. Brennan, Payne S. Harris, Robert Emerson Carter, and Wright H. Langham. Feb. 15, 1952. 101p. (LA-1408)

Female Swiss mice were exposed to graded doses of 250-kvp x rays and to mixed radiation (thermal neutrons plus gamma rays) in the thermal column of a homogeneous reactor. The LD_{50} (30 days) was observed for both groups and the curves for probit of mortality versus log of exposure were found to be parallel. To obtain a figure for the biological effectiveness of thermal neutrons it was necessary to assess three major inherent correction factors resulting from the following experimental conditions: (1) The thermal neutron flux from a nuclear reactor is always accompanied by a gamma flux. (2) A mouse in a slow neutron flux becomes a gamma ray source and consequently mice exposed side by side increase each other's dose over and above the dose that one mouse alone would receive. (3) To some extent mice exposed together shield each other from the neutron flux. When these correction factors were taken into account it was found that $1.37 \pm 0.21 \times 10^{10}$ thermal neutrons per cm^2 delivered a dose of 1 rem. The relative biological effectiveness (RBE) of the thermal neutrons was calculated to be 1.70. The dose in roentgens due to the gamma contaminant in the thermal column radiation was measured separately by means of an r-chamber surrounded by various thicknesses of metallic lithium. The lithium effectively absorbed the slow neutrons because of the $Li^6(n,\alpha)T$ reaction. Physical measurements were made which showed that the gamma flux inherent in the thermal column has an effective average energy of ~4 Mev and appears to arise from slow neutron capture in graphite. The RBE of the inherent gamma contaminant in the thermal column was determined by exposing mice inside an adequate lithium shield. The RBE was found to be quite low (0.53). (auth)

14
Los Alamos Scientific Lab.
THE BIOLOGICAL EFFECTIVENESS OF THERMAL NEUTRONS DETERMINED BY THE DECREASE IN WEIGHT OF THE SPLEEN AND THYMUS OF THE MOUSE, by Payne S. Harris and James T. Brennan. May 6, 1952. 33p. (LA-1410)

Female CF-1 mice were exposed to various radiation sources, including a 250-kvp x-ray machine and a homogeneous reactor. Regression curves of radiation response vs. exposure were determined using the weight loss of the spleen and thymus as a biological indicator of radiation effect. These results indicated that the gamma radiation produced in the homogeneous reactor had a biological effectiveness of 0.6 to 0.8 when compared to the effect of the 250-kvp x-ray spectrum. The biological effectiveness of thermal neutrons determined by this method indicated that $1.25 \pm 0.25 \times 10^{10}$ thermal neutrons/cm^2 were equivalent to 1 r of the x radiation. (auth)

15
Los Alamos Scientific Lab.
INCIDENCE OF LENS OPACITIES IN MICE EXPOSED TO X RAYS AND THERMAL NEUTRONS, by John Storer and Payne Harris. July 1952. 27p. (LA-1455)

The incidence of lens opacities in Swiss mice exposed to 250-kvp x rays and to the mixed radiation of the thermal column of the Los Alamos homogeneous reactor has been determined at various times after radiation exposure. When a relative biological effectiveness (RBE) of one was assumed for the gamma contaminant in the thermal column flux, and the RBE for thermal neutrons was calculated from the data collected 30 weeks after radiation exposure, the RBE of thermal neutrons was estimated to be approximately 15, and 1.6×10^9 neutrons/cm^2 was equivalent to one rem. The RBE of thermal neutrons calculated on the basis of the production of lens opacities was approximately nine times the RBE calculated on the basis of the production of lethality at 30 days. The RBE of thermal neutrons based on 30 day lethality was not significantly different from the RBE based on lethality at 30 weeks. (auth)

16
Naval Medical Research Inst., Bethesda
THE USE OF SMALL LABORATORY ANIMALS IN MEDICAL RADIATION BIOLOGY. PART I. APPLICATION OF A 200 K.V.P. X-RAY THERAPY UNIT TO LETHAL DOSE STUDIES, by Friedrich Ellinger, Jasper E. Morgan, and Francis W. Chambers, Jr. Apr. 30, 1952. 35p. (NP-4120; U23980)

A critical study of irradiation techniques and apparatus has been undertaken, with particular reference to the effective application of conventional x-ray therapy equipment. Measurements were made on a Picker therapy unit with a maximum rating of 220 kvp at 10 ma. Dose measurements were made with a Victoreen condenser r meter. An Esterline-Angus 0- to 1-ma d-c variable-speed recorder, fitted with a 117Z6 full-wave electronic rectifier and appropriate multiplying resistors for critically damped voltage calibration, was used for line voltage measurements. With a GE 5 kv-amp stabilizer installed between the x-ray generator and the 220-v distribution panel, recorded fluctuations fell to an amplitude consistently less than 1%. The built-in-filament stabilizer of the x-ray generator was removed, the automatic timer was shifted from the high tension primary to the shutter circuit, and phantoms were constructed of 0.25-in. tempered Masonite sheets, 36 × 36 cm, with a mean density of 1.01 ± 0.02 g/cc. Me methacrylate exposure containers were laid out in a swastika arrangement, giving approximately uniform simultaneous exposures to the 12 mice or 2 guinea pigs they can hold. The radiation quality is variable from a half-value layer (H.V.L.) of 2.3 mm Al to 1.8 mm Cu. The incident backscatter becomes constant in each case after approximately a 10-cm thickness of Masonite, while the harder radiations approach an H.V.L. near 0.25 mm Cu after traversing large thicknesses of Masonite. The results indicate that conventional x-ray therapy equipment can be readily adapted to effective use in experimental radiation biology. (TID-LC)

17
Atomic Energy Project, Western Reserve Univ.
QUARTERLY PROGRESS REPORT [FOR] APRIL, MAY, JUNE 1952. [nd] 5p. (NYO-1647)

Rats exposed to an LD_{50} dose of x radiation on the 11th and 18th days after treatment with 0.2 mg/kg of nitrogen mustard showed no significant difference in survival when compared with untreated controls. Comparison of data on the effects of splenectomy on radiosensitivity of the mouse with data previously obtained for rats indicates that the spleen plays a much more prominent role in the survival of the mouse than of the rat following x irradiation. Preliminary studies indicate that, on a μc/g of tissue basis, colloidal Au^{198} is more toxic and that P^{32} is much less toxic in the mouse than in the rat. Hippuric acid excretion studies following oral administration of sodium benzoate as an index of liver function in rats indicated an early depression in function corresponding to the period of maximal weight loss following intravenous injection of 28 μc/g colloidal Au^{198}. Recovery was rapid and normal function was indicated from the 12th to the 34th day, after which a progressive depression of liver function was noted. Data on tissue distribution of Au from intravenously injected tracer doses of colloidal Au^{198}

and on the tissue distribution of P^{32} injected intraperitoneally as Na_2HPO_4 in mice are presented in tabular form. The incorporation of C^{14}-labeled orotic acid into desoxypentose nucleic acid of rat thymus was studied in normal and x-irradiated animals. Appreciable C^{14} appeared in the DNA pyrimidines, but not in purines of control rats. The specific activity of the thymus DNA pyrimidines from x-irradiated rats was only about one-fourth of the normal value. (C.R.)

18

Radiation Lab., Univ. of Calif., Berkeley
MEDICAL AND HEALTH PHYSICS QUARTERLY REPORT [FOR] APRIL, MAY, AND JUNE, 1952. Aug. 21, 1952. 84p. (UCRL-1922)

Separate abstracts have been prepared on two sections of this report.

19

Radiation Lab., Univ. of Calif., Berkeley
THE METABOLIC PROPERTIES OF VARIOUS MATERIALS, p.2-38 of MEDICAL AND HEALTH PHYSICS QUARTERLY REPORT [FOR] APRIL, MAY, AND JUNE, 1952. Aug. 21, 1952. 37p. (UCRL-1922(p.2-38))

Data for the tissue distribution of I^{131} in the rat are presented in tabular form and factors affecting I metabolism are discussed. A comparison of the distribution of mixed fission products in rats and in monkeys indicates the fate of these materials in the primate is very similar to that in the rodent. Data on the effects of injected fission products on the blood count of the monkey are presented in tabular form. In a study of the effects of tracer and therapeutic amounts of Na^{24} in alteration of the Na space of radiosensitive tissues, data are presented in tabular form on both the tissue distribution of Na and the ratio of Na tissue concentration over plasma concentration two and five days after intraperitoneal injection of 0.83 mc and 7.0 mc of Na^{24}, respectively. The leaching action on At of fixative agents and solvents employed to fix, dehydrate, and clear the intact thyroid glands of rats which had received At was investigated and data are tabulated. Studies of the products formed by high-energy helium-ion irradiation of oxygen-saturated solutions of acetic acid containing $CH_3C^{14}OOH$ have been continued and data are presented on the production of succinic, tricarballylic, malonic, malic, and citric acids. Data on gaseous products and H_2O_2 from the irradiated acetic acid solution are included. (C.R.)

20

Radiation Lab., Univ. of Calif., Berkeley
BIOLOGICAL STUDIES OF RADIATION EFFECTS, p.40-80 of MEDICAL AND HEALTH PHYSICS QUARTERLY REPORT [FOR] APRIL, MAY, AND JUNE, 1952. Aug. 21, 1952. 41p. (UCRL-1922(p.40-80))

An investigation was made of the radiation sensitivity of diploid and haploid Saccharomyces cerevisiae. In some instances of preirradiation, increased radiosensitivity was accompanied by reduced vigor of growth. Many colonies derived from preirradiated radiation-sensitive diploid cells reverted to normal, both in radiation sensitivity and in vigor. The reversion process was stepwise and appeared to depend on the number of cell divisions that occurred. Data are presented on the distribution of types of defective cells after a given dose of preirradiation. Data indicate that aerobic or anaerobic conditions during growth after irradiation makes no significant difference in the percent survival, but there is a definite dose-reduction factor for cells irradiated in the absence of oxygen as compared with cells irradiated in air. Data are included in a comparison of the x ray sensitivity of haploid and diploid yeast cells with triploid and tetraploid cells of the same strain. (C.R.)

21

Atomic Energy Project, Univ. of Rochester
HISTOPATHOLOGY OF ALPHA RADIATION FROM INTERNALLY ADMINISTERED POLONIUM, by George W. Casarett. Aug. 25, 1952. 267p. (UR-201(pt.I))

Part I of a detailed, two-part report of the sequence of histopathologic and hematologic changes occurring in the organs of rats receiving single intravenous injections of Po, administered as the chloride, at dosage levels of 1, 5, 10 and 20 μc/kg is presented. The biologic effects of radiation in general, properties of α particles, properties of Po, and biologic distribution and excretion of Po are reviewed. Preliminary data are included on the physical condition and care of animals, Po solutions and dosage, details of injection procedure, hematology schedule and methods, sacrifice schedule and histologic techniques used in the experiment. Data are included also on histopathological and hematologic changes in the testis, lymph nodes, spleen, bone marrow and thymus of rats following injection of Po. (C.R.)

22

Atomic Energy Project, Univ. of Rochester
HISTOPATHOLOGY OF ALPHA RADIATION FROM INTERNALLY ADMINISTERED POLONIUM, by George W. Casarett. Aug. 25, 1952. 563p. (UR-201(pt.II))

A detailed report of the sequence of histopathologic and hematologic changes occurring in the organs of rats receiving single intravenous injections of Po, administered as the chloride, at dosage levels of 1, 5, 10 and 20 μc/kg is presented in two parts. Included in this Part II are data on histopathological and hematologic changes in circulating blood cells, bone, kidney and other organs, and blood vessels of rats following injection of Po. A summary of tumors produced is included. 332 references. (C.R.)

23

Atomic Energy Project, Univ. of Rochester
X-IRRADIATION INJURY AND REPAIR IN THE GERMINAL EPITHELIUM OF MALE RATS. I. INJURY AND REPAIR IN ADULT RATS, by Samuel Lelus Shaver. Sept. 23, 1952. 47p. (UR-218)

The testes of adult male rats given total-body x irradiation of 500 r showed a unique type of injury characterized by temporary inhibition (about 4 weeks) of mitosis in dust-like spermatogonia. More mature germ cells continued maturation, leading to a maturation-depletion of the germinal epithelium. Since it required about 4 weeks for the latter to reach completion, it is suggested that this time interval may represent the approximate duration of spermatogenesis, although it is realized that x rays may retard this process. The maturation-depletion was followed by a spontaneous and gradual repopulation, beginning after 4 to 5 weeks and reaching completion after 4 to 5 months. The dose of 1005 r, administered locally to the scrotum, resulted in permanent suppression of spermatogonial division and degeneration of more mature germ cells, ending in a subtotal denuding of germinal epithelium (at 21 days) from which no regeneration occurred. Dust-like spermatogonia were found to be the most radiosensitive cells with respect to inhibition of mitosis but the most radioresistant, with exception of sperm, in their ability to withstand irreparable destruction by x rays. Regeneration is believed to have occurred from dust-like spermatogonia which were not destroyed, but only suppressed, by the x-ray treatment. 47 references. (auth)

24

Atomic Energy Project, Univ. of Rochester
X-IRRADIATION INJURY AND REPAIR IN THE GERMINAL EPITHELIUM OF MALE RATS. II. INJURY AND REPAIR IN IMMATURE RATS, by Samuel Lelus Shaver. Sept. 23, 1952. 20p. (UR-219)

Immature rats from 1 to 50 days of age were treated with total-body irradiation dosages ranging from 300 to 500 r. The injury and regeneration patterns were studied in the testis. Testis response in rats irradiated between the ages of 35 and 50 days was essentially the same as that seen in adults. In younger animals testicular damage was much greater than that in adults after comparable doses. The dust-like spermatogonia of the immature animals were found to be less radiosensitive than those of adults with respect to mitotic inhibition, but more radiosensitive with respect to irreparable morphologic damage. The more mature germ cells in immature rats were much more susceptible to x-irradiation effects than those of adults. Those germ cells not destroyed by the treatment were not retarded and continued maturation. This observation supports the conclusion that the process of spermatogenesis in the rat requires about 27 days, since this is the length of time required for maturation-depletion following a selective spermatogonial mitotic block. (auth)

25

THE DIRECT EFFECTS OF RADIATION ON ERYTHROCYTES. C. W. Sheppard and Marian Stewart. J. Cellular Comp. Physiol. 39, 189-215(1952) July.

Preliminary studies are reported on the direct effects of x radiation on the ability of erythrocytes to maintain concentration gradients of cations between the cell contents and the surrounding medium. Carefully controlled in vitro studies of K leakage, using K^{42} as a tracer, in nonirradiated control systems and following exposure of human erythrocytes to various radiation doses are described. The loss of K selectivity as indicative of cell disturbance due to ionizing radiation and mechanisms involved in this cell disorganization are discussed. (C.R.)

26

LOW-VOLTAGE ELECTRON BOMBARDMENT OF BACTERIAL SPORES. Marguerite Davis and Franklin Hutchinson. Arch. Biochem. and Biophys. 39, 459-61(1952) Aug.

Preliminary data are presented in a study of survival of B. subtillis spores as a function of electron dose at various voltages. (C.R.)

27

A STUDY OF THE SHORT-TIME EFFECTS ON THE MOUSE OVARY OF INTERNAL IRRADIATION WITH P^{32}. Erik Odeblad. Acta Radiol. 38, 33-40(1952) July.

Adult female mice were given 0.1, 0.3, 1.0, 3, 10 and 30 μc of P^{32} per g and killed after 48 or 96 hours. At the higher doses there was a considerable loss in weight and signs of estrogenic stimulation were absent in the vaginal smears and the endometrium; autoradiographs showed a decreased uptake of P^{32}. In the ovary the granulosa tissue was most radiosensitive, changes appearing at 3 μc/g. The interstitial gland appeared to be the least radiosensitive, the other tissue components having intermediate sensitivities. (auth)

28

THE BIOLOGICAL ACTION OF X-RAYS AND FAST NEUTRONS ON BARLEY AND WHEAT. James Mac Key. Arkiv Botanik 1, 545-56(1952)

Dry dormant seeds of barley and wheat as well as presoaked barley seed of high metabolic activity have been irradiated by x rays and fast neutrons. The treated material has been followed through two generations and the frequency of primary chromosome disturbances, the retarding effect on sprouting, the death-rate, the induced degree of sterility in the first generation and the frequency of certain types of mutation in the second have been examined. From the genetical standpoint, neutrons were shown to be decidedly more efficient than x rays, and this more pronounced if the effect of the irradiation was studied first when a series of cell divisions had intervened. This circumstance is explained by a pronounced contra-selection, due to physiological reactions of high lethality induced by x rays but of subordinate importance in connection with neutrons. Such a conception fits with the different shape of the curves relating retardation of sprouting, survival, and plant fertility as well as earlier observations on the time factor. (auth)

29

EFFECTS OF IONIZING RADIATIONS IN BARLEY. L. Ehrenberg, A. Gustafsson, and N. Nybom. Arkiv. Botanik 1, 557-68(1952)

The present study aims at a comparison of data gathered concerning the mutagenic effects of x rays, neutrons, α rays from Ra, and β rays from P^{32} and S^{35}. Seeds of different metabolic activity (dry dormant seeds as well as presoaked germinating seeds) were treated in various ways with the agents mentioned. The radiations may act in different ways owing to differences in ionization density, distribution of the ionizing rays within the object (a homogeneous distribution of the ionizing particles from x and neutron rays versus a chemically determined unequal distribution of isotopes), and the duration of the time of action of isotopes. Another object of the investigation was to determine whether the various mutation types appearing in the second generation show any special grouping regularity in relation to the source of radiation or the metabolic state of the seed material used. (auth)

30

ELECTRON BEAMS STERILIZE FOOD AND DRUGS. E. Alfred Burrill and A. John Gale. Electronics 25, 98-101 (1952) Nov.

The importance of the scanning system used with high-energy electron beams to give uniform sterilization of sealed products moving through the beam on high-speed conveyor belts is stressed. A 200-cps scanning circuit to sweep the beam through an 8° arc is diagramed. Elaborate fail-safe provisions are included. (G.Y.)

31

HISTOPATHOLOGICAL CONTRIBUTION TO THE KNOWLEDGE OF DELAYED LESIONS OF THOROTRAST. Nino Frongia and Virgilio Costa. Arch. ital. anat. e istol. patol. 25, 279-301(1952). (In Italian)

Serious and extensive sclerotic lesions in liver, spleen, and lymphatic glands of a woman inoculated 15 yr before with thorotrast (ThO_2) are described. The changes are ascribed to the combined mechanically irritating and radioactive effects of the thorotrast on the tissues, in which it is indefinitely fixed. 12 figures. (auth)

32

MITOTIC RHYTHM IN CARCINOMAS OF HUMAN SKIN UNDER THE INFLUENCE OF CHAOUL RADIATION. II. Roderich Helmke. Strahlentherapie 88, 123-8(1952). (In German)

The effect of daily doses of 300 or 500 r of Chaoul radiation on the mitotic rhythms of ten prickle-cell and eight basal-cell carcinomas of human skin was studied. A gradual drop in the number of mitotic figures was observed in nearly all the carcinomas. In some cases, one or two delayed waves appeared on the graphs of mitosis numbers. (G.Y.)

33

EFFECT OF ROENTGEN RAYS DURING VARIOUS PHASES OF THE HAIR CYCLE OF THE ALBINO RAT. John R. Geary, Jr. Am. J. Anat. 91, 51-106(1952) July.

The effects of low-voltage x rays on the hair follicle of the Sherman strain albino rat during various phases of the hair cycle are discussed. 72 references. (C.R.)

34

THE LIMITS OF THE TARGET THEORY OF THE BIOLOGI-

CAL ACTION OF RADIATION. B. Rajewsky. Brit. J. Radiology 25, 550-52(1952) Oct.

Mechanisms by which the act of ionization results in biological damage are reviewed. Experimental results are reported, from studies on seeds and pollen irradiated at low temperatures, which indicate that diffusion and energy-conducting processes are important factors in biological damage, and that only a small fraction of the primary processes in the biological actions of ionizing radiations are explicable in terms of the classical target theory. (C.R.)

35

X-RAY ULCERS OF THE UPPER INTESTINAL SEGMENTS FOLLOWING IRRADIATION OF CERVICAL CARCINOMAS. W. Hinz and W. Mohnke. Zentr. Gynäkol. 74, 734-48(1952). (In German)

X-ray ulcers of the upper intestine, observed at autopsy of a patient who had undergone extensive x-ray and Ra therapy for cancer of the cervix, are described. The possibility of serious intestinal damage, even under today's irradiation procedures, is emphasized. (tr-auth)

36

MAXILLARY SINUS CARCINOMA CAUSED BY RADIUM-CONTAINING CONTRAST AGENTS. O. Hofer. Deut. Zahnärztl. Z. 7, 736-41(1952) July 1. (In German)

The right maxillary sinus of a 64-yr-old patient had been filled 10 yr before with thorotrast for radiographic contrast purposes. Complete retention of the thorotrast and development of a slightly cornified epithelioma are noted. The necessity of keeping under observation everyone to whom this contrast agent had been applied and of possibly removing hidden deposits is stressed. (G.Y.)

37

ROENTGEN IRRADIATION AND THE ADRENAL GLAND. Manuel A. Manzanilla, Jr. Med. rev. mex. 32, 371-5(1952). (In Spanish)

The effect of x radiation on the adrenal gland is reviewed, a distinction being made between direct and indirect effects. Agreements and differences among the published experimental data are discussed. 62 references. (G.Y.)

38

THE EFFECTS OF BETA RAYS ON THE CONDUCTED ACTION POTENTIALS OF NERVES. Edgar Lionel Gasteiger, Jr. Ph.D. Thesis, Univ. of Minnesota, 1952.

A critical review of previous investigations concerned with the effects of ionizing radiations on peripheral nerves reveals the following points. Peripheral nerves, like central nervous tissue, are highly resistant to irradiation. Young or embryonic nerves are more sensitive than mature fibers. A three-stage response is seen in the irradiated peripheral nerve. These effects are reversible if the irradiation is not excessive. Sufficient irradiation produces the histological changes observed in Wallerian degeneration. Finally, the three-stage change and its reversibility is observed for ultraviolet light as well as for the more strongly ionizing radiations. Original experiments on the effects of Rn β particles on the action potentials of excised sural, saphenous, and vagus nerves of cats were performed. A discussion is presented attempting to explain the survival curve shape and relating the β-ray effects to those of other agents. (G.Y.)

RADIATION HAZARDS AND PROTECTION

39

Army Medical Research Lab., Fort Knox

TETRAZOLIUM SALTS AS PROTECTORS AGAINST LETHAL EFFECTS OF X-RAYS, by N. Puckett, S. Bellack, and A. T. Krebs. Mar. 5, 1952. 9p. (AMRL-77)

The administration of a tetrazolium compound before irradiation produced a definite protection against lethal effects of x rays in mice. Possible mechanisms by which these oxidizing substances provide protection are discussed. (C.R.)

40

Atomic Energy Project, Univ. of Calif., Los Angeles

INABILITY OF FLAVONOIDS TO MODIFY ROENTGEN RAY IRRADIATION MORTALITY IN GUINEA PIGS, by Thomas J. Haley and Samuel Mann. Issued Sept. 22, 1952. 9p. (UCLA-224)

When female guinea pigs are given pre- or post-irradiation injections of rutin (250 mg/kg), hesperidin (25 mg/kg), hesperidin methyl chalcone (100 mg/kg) or naringin (75 mg/kg), none of these flavonoids favorably influenced the mortality produced by 200-r acute whole-body x irradiation. Post-irradiation medication with these flavonoids definitely increased the rate of mortality, as did pre-irradiation medication with hesperidin and naringin. Thus it appears that flavonoid medication is of little or no value in the treatment of irradiation injury and, in fact, it may be highly detrimental. (auth)

41

Radiation Lab., Univ. of Calif., Berkeley

SPECIAL EQUIPMENT FOR THE CARBON-14 LABORATORY, by B. M. Tolbert, N. Garden, and P. T. Adams. Sept. 29, 1952. 10p. (UCRL-1955)

Two pieces of equipment have been designed for the laboratory in which large amounts of C^{14} are handled. One of these, a vented housing for a vacuum manifold, protects the chemist against ingestion of large amounts of radioactivity. The other, a hooded cleaning area, makes possible a safe, thorough, and reproducible decontamination procedure. (auth)

42

HARMFUL EFFECTS OF X RAYS AND RADIOACTIVE EMANATIONS FROM THE POINT OF VIEW OF LEGAL MEDICINE. Rodolfo Bramanti Jauregui. Rev. sanid. milit. Argentina 51, 174-206(1952). (In Spanish)

Medical jurisprudence involves decisions on the causal relation between radiations and injuries, degree of incapacity resulting from radiation injuries, and assignment of responsibility for radiation safeguards in industry. Medical aspects of radiation injuries and pertinent Argentine laws are summarized. (G.Y.)

RADIOGRAPHY

43

THE RADIOGRAPHY OF THE HUMAN BODY WITH RADIOACTIVE ISOTOPES. W. V. Mayneord. Brit. J. Radiology 25, 517-25(1952) Oct.

Direct applications of radioactive isotopes in radiography of the human body are discussed. The possibility of using radioisotopes as direct substitutes for x-ray sources in classical diagnostic techniques and of using small internal sources of low-energy radiation are considered, and the physics of low-energy γ emission is reviewed. Data from studies of the absorption of the radiations from Tm^{170} in a variety of substances, both in regard to its absorption in tissues and also the choice of protective materials, are presented. Preliminary radiographic experiments using a point source made of chips of radioactive TmO sealed into the bottom of a tube are reported in which radiograms of teeth were made by placing the source at the center of the buccal cavity of a dried skull. Future applications of the technique to dental and skull radiography and in scanning techniques are discussed. (C.R.)

RADIOTHERAPY

44

A 10-CURIE Co^{60} TELEGAMMA UNIT. Kurt Lidén. Acta

Radiol. 38, 139-42(1952) Aug.

A 10-curie Co^{60} telegamma unit, 6.5 cm focal-skin distance, is now in operation at King Gustaf V's Jubilee Clinic, Lund, Sweden. The mounting of the Co^{60} sources is briefly described. Depth doses measured in a water phantom show only small differences from those of Ra at the same distance. Clinical experience of the treatment seems to indicate that the skin reaction to Co^{60} irradiation is milder than to an equivalent Ra dose. (auth)

45

A FLEXIBLE LINEAR GAMMA-RAY SOURCE (Co^{60}) FOR THE TREATMENT OF CANCER OF THE UTERINE BODY. D. E. A. Jones. Acta Radiol. 38, 41-48(1952) July.

A description is given of a simple form of applicator for the treatment of cancer of the uterine body, embodying a flexible linear gamma-ray source. This source, loaded differentially to give a favorable physical dosage distribution, particularly at the fundus, consists of a series of short rods of metallic Co^{60} supported within a closely wound helix of stainless steel wire. This forms a loop contained by the endometrial surfaces and is adjustable in length to fit the dimensions of the cavity. The individual sources are nickel-plated to absorb the 0.3-Mev β rays and to obviate toxicity reactions. (auth)

46

BLOOD RADIOIODINE CONCENTRATION AND BLOOD RADIATION DOSAGE DURING I^{131} THERAPY FOR METASTATIC THYROID CARCINOMA. S. M. Seidlin, A. Aaron Yalow, and Edward Siegel. J. Clin. Endocrinol. and Metab. 12, 1197-1204(1952) Sept.

The radiation dosage delivered to the blood as well as to the whole body during radioiodine therapy was determined for 23 patients with metastatic thyroid carcinoma. Data obtained for four days or more following ingestion of radiation thyroidectomizing and postthyroidectomy doses of radioiodine are presented. In the patients studied no untoward effects, other than temporary leukopenia, followed the administration of a single therapeutic dose of radioiodine, but in 2 out of 13 patients persistant leukopenia developed after treatment with several large doses of radioiodine. (C.R.)

47

DEPTH DOSE DATA, 150 KVP TO 400 KVP. H. E. Johns, S. O. Fedoruk, R. O. Kornelsen, E. R. Epp, and E. K. Darby. Brit. J. Radiology 25, 542-9(1952) Oct.

Depth-dose measurements have been made in a water phantom with a small ionization chamber connected to an automatic recording system. Results are reproducible to within 0.5 per cent. Measurements were made for areas from 0 to 400 cm^2, focal-skin distances from 40 to 100 cm, half-value layers from 0.5 to 5 mm Cu, and depths from 0 to 20 cm. The data obtained will be included in a collection of Central Axis Depth Dose Data to be published as Supplement No. 5 to Brit. J. Radiology. (auth)

48

THE EFFECT OF PROPYLTHIOURACIL ON THE THYROID UPTAKE OF I^{131} AND THE PLASMA CONVERSION RATIO IN HYPERTHYROIDISM. Alvin L. Schultz and Wyman E. Jacobson. J. Clin. Endocrinol. and Metab. 12, 1205-14(1952) Sept.

The thyroid uptake of tracer doses of I^{131} and the plasma I^{131} conversion ratio were studied in 9 hyperthyroid patients before, during, and shortly after treatment with propylthiouracil. Data are presented which support the concept that propylthiouracil primarily blocks hormone synthesis by the thyroid gland. (C.R.)

49

BONE MARROW CONDITIONS IN RHEUMATIC PATIENTS AND THEIR INFLUENCING BY THERMAL CAVE TREATMENT IN THE BÖCKSTEIN AT BADGASTEIN. K. Inama. Wien. Z. inn. Med. 33, 241-5(1952). (In German)

Treatment of rheumatic patients in the Böckstein caverns, a natural vaporarium at Badgastein, Austria, consists in resting for 1 hr at 40.8 to 41.6°C, 95 to 98% relative humidity, and 4×10^{-9} c/l Rn concentration. Sternal marrow studies on eight chronic polyarthritis and polyarthrosis patients before and after 10 or more treatments indicated a general stimulation of bone marrow function and, in most cases, hyperplasia of the erythropoietic system, particularly a moderate lymphocyte increase at the expense of granulopoiesis. Of interest was the apparently regular appearance of basophil cells. Plasma cell increases and marrow eosinophilia were found in only one-fourth of the cases. Symptomatic improvement in anemic conditions was noted. (G.Y.)

50

ATTEMPTS AT TREATMENT OF ACUTE LEUKOSIS BY REINJECTION OF THE PATIENT'S OWN BLOOD IRRADIATED WITH X RAYS. P. Croizat, L. Revol, J. Papillon, Pinet, and Bussy. Sang, Le 23, 537-9(1952). (In French).

A brief summary of attempts to treat acute leukemia by collection of 100 to 150 cc (from adults) of blood in 10 to 15 cc of 5% Na citrate, x irradiation with 100 or 200 r, and reinjecting into the patient indicates that (1) too large a blood sample or too intense an irradiation often aggravates the disease, (2) the correct dose may result in some amelioration, usually limited to certain symptoms such as bone pains, chloromatous tumors, and leukosis. (G.Y.)

TOXICOLOGY STUDIES

51

Atomic Energy Project, Univ. of Calif., Los Angeles
INTRAVENOUS AGENTS DIMINISHING ACCUMULATION OF METAL IONS. I. LEAD, by Norman S. MacDonald, Florita Ezmirlian, Patricia Spain, and Donald E. Rounds. Issued Oct. 17, 1952. 12p. (UCLA-229)

A preliminary search for readily available chemical agents, suitable for intravenous administration and possibly of use in therapy of poisoning by metals which accumulate in bone, was carried out. Young rats were injected intravenously with 25 mg of Pb^{++} per kg of body weight, followed ½ hr later by an injection of the chemical agent. After one day, the femurs and livers were removed and analyzed for Pb^{++} by a polarographic technique. The same agents were also tested by administration ½ hr before the lead. The materials tested were the tetra sodium salt of ethylene diamine tetraacetic acid, casein hydrolysate, pectin, a copolymer of methyl vinyl ether and maleic anhydride, glucuronolactone, oxypolygelatin, polyvinyl pyrrolidone, dextran, sodium thiosulfate, and a hydrolyzed polyacrylonitrile. The first four agents significantly reduced the bone burden of lead and the first seven agents showed enough promise to merit further detailed evaluation. The liver burden of lead also tended to decrease in the cases where the bone burden was lowered. (auth)

52

THE LATE EFFECTS OF INTERNALLY-DEPOSITED RADIOACTIVE MATERIALS IN MAN. Joseph C. Aub, Robley D. Evans, Louis H. Hempelmann, and Harrison S. Martland. Medicine 31, 221-329(1952) Sept.

Case histories of thirty persons containing internally deposited Ra, alone or in combination with mesothorium, are presented. Most of these individuals were exposed at least 25 yr ago. The Ra deposited in the body of each person was measured by standardized techniques. Physical characteristics observed are summarized and the role of internally deposited radioactive materials in mortality rate, incidence of illness, and severity of symptons during illness of surviving patients are discussed. The biological and physi-

cal properties of Ra and mesothorium are reviewed and physical aspects of Ra and mesothorium toxicity are discussed. (C.R.)

53

INVESTIGATIONS INTO THE PROBLEM OF RADIUM POISONING. VI. RESULTS ON ELIMINATION OF RADIOACTIVE SUBSTANCES FROM THE HUMAN BODY FOUND IN TWO RADIUM POISONING CASES. B. Rajewsky and H. Muth. Strahlentherapie 88, 261-75(1952). (In German)

In two cases of Ra poisoning, one arising from inhalation of the products of a Ra-Be neutron source explosion, the other from intravenous injection of a Ra solution in a suicide attempt, the Ra excretion in stool and urine was followed during the first week after the poisoning. Estimated excretion coefficients are tabulated and graphed. (G.Y.)

54

EXPERIMENTAL RESEARCH ON OCULAR BERYLLIUM LESIONS. P. F. Ferraris De Gaspare. Boll. oculist. 31, 337-46(1952). (In Italian)

The effects of technically pure Be and Be sulfate, fluoride, citrate, and carbonate on the rabbit cornea have been studied. The soluble substances were applied to the corneal parenchyma by intracorneal injection while the insoluble ones were introduced through an opening in the cornea. The animals were followed up for 8 months. From the resulting observations, the author draws the following conclusions: Be sulfate and fluoride act only as caustic agents. Be citrate, being rapidly eliminated from tissues, does not produce specific changes. Technically pure Be remains in the tissues without producing any particular changes. Be carbonate, which has a low degree of solubility and dissociation, produces the characteristic changes observed in human pathology. (G.Y.)

TRACER APPLICATIONS

55

[Wisconsin Univ.]

THE USE OF RADIOACTIVE ISOTOPES TO ASCERTAIN THE ROLE OF ROOT-GRAFTING IN THE TRANSLOCATION OF WATER, NUTRIENTS, AND DISEASE-PRODUCING ORGANISMS AMONG FOREST TREES, by C. H. Beckman, J. E. Kuntz, and A. J. Riker. [nd] 8p. (AECU-2275)

The translocation of water, nutrients, and disease agents within and between forest trees was studied by tracing the movement of poisons, $Rb_2^{86}CO_3$, and spores labeled with $Ag^{110}I^{131}$ precipitate. The rate and relative amounts of translocation were determined by examining trunks and leaves for radioactivity at given time intervals. Data are presented graphically. (C.R.)

56

Radiation Lab., Univ. of Calif., Berkeley

THE PATH OF CARBON IN PHOTOSYNTHESIS. XVII. PHOSPHORUS COMPOUNDS AS INTERMEDIATES IN PHOTOSYNTHESIS, by J. G. Buchanan, J. A. Bassham, A. A. Benson, D. F. Bradley, M. Calvin, L. L. Daus, M. Goodman, P. M. Hayes, V. H. Lynch, L. T. Norris, and A. T. Wilson. July 8, 1952. 32p. (UCRL-1871)

Studies of CO_2 fixation in green plants using C^{14} as a tracer indicate that CO_2 reacts with a C_2 compound to give phosphoglyceric acid. New kinetic data lead to the conclusion that sedoheptulose phosphate and ribose diphosphate are concerned in the early stages of CO_2 fixation. Preliminary experiments, employing radioautography and two-dimensional paper chromatography, indicate that variations in light intensity, CO_2 pressure and other external factors have a profound effect on the total fixation and on the fixation pattern of C by the plant cell. Experiments are described which were aimed at the separation and identification of the organic phosphates which are among the early products of photosynthesis. (C.R.)

57

Radiation Lab., Univ. of Calif., Berkeley

THE PATH OF CARBON IN PHOTOSYNTHESIS. XIX. THE IDENTIFICATION OF SUCROSE PHOSPHATE IN SUGAR BEET LEAVES, by J. G. Buchanan. Sept. 1952. 15p. (UCRL-1946)

The recognition and characterization of a sucrose phosphate as an intermediate in sucrose synthesis by green plants is described. A tentative structure for this phosphate is proposed and its mode of formation suggested. (auth)

58

Radiation Lab., Univ. of Calif., Berkeley

PHOSPHORUS AND PHOTOSYNTHESIS. I. DIFFERENCES IN THE LIGHT AND DARK INCORPORATION OF RADIOPHOSPHATE, by M. Goodman, D. F. Bradley, and M. Calvin. Oct. 1952. 25p. (UCRL-1956)

The distribution of radioactivity in metabolites of photosynthetic algae exposed to $KH_2P^{32}O_4$ in light and dark has been determined by paper chromatography and radioautography. The large relative increase of adenosine triphosphate in the dark and of 3-phosphoglyceric acid in the light is discussed in relation to the mechanism of phosphorylation of photosynthetic intermediates. Evidence is given indicating that adenosine triphosphate is the first isolable product formed from inorganic phosphate, and that uridine diphosphate glucose and adenosine diphosphate are active in phosphate metabolism. (auth)

59

Radiation Lab., Univ. of Calif., Berkeley

CO_2 FIXATION BY EUGLENA, by V. H. Lynch and M. Calvin. Oct. 13, 1952. 22p. (UCRL-1966)

A survey of metabolic reactions of Euglena is reported in which tracer techniques were used to determine CO_2 fixation and paper chromatography was used to separate and identify the metabolic products formed. Characteristics of the dark fixation of CO_2 by Euglena were found to be different from that in all other organisms so far examined and the possible significance of these facts with respect to the phylogenetic relationships of Euglena is discussed. (C.R.)

60

Atomic Energy Project, Univ. of Rochester

THE RELATION OF PROTEIN SYNTHESIS TO NUCLEIC ACID PHOSPHORUS TURNOVER IN THE RAT LIVER, by Doris R. Frankel. Sept. 10, 1952. 59p. (UR-216)

Protein synthesis and its relation to nucleic-acid phosphorus turnover were studied in the adult rat liver. Both whole animals and isolated perfused livers were used. Protein synthesis was determined by measuring the C^{14} activity in plasma and liver proteins after administration of either lysine-ϵ-C^{14} or histidine-2-C^{14}. Nucleic-acid phosphorus turnover was determined by measuring the P^{32} activity in the isolated-liver nucleic acids after administration of $Na_2HP^{32}O_4$. By giving either the labeled amino acid only or that amino acid plus a complete amino-acid supplement, the amount of protein synthesis could be varied and the nucleic-acid phosphorus turnover then compared in the cases of high or low synthesis. The amino-acid supplement was most effective in varying the plasma-protein synthesis in the isolated perfusion experiments. In these as well as the other experiments, nucleic-acid phosphorus turnover did not correlate either with rate or amount of protein synthesis, thus indicating that any relation between protein synthesis and nucleic acids is not manifested by corresponding rates of renewal. (auth)

61
PHARMACOLOGICAL STUDIES OF RADIOGERMANIUM (Ge^{71}). H. C. Dudley and E. J. Wallace. Arch. Ind. Hyg. Occupational Med. 6, 263-70(1952) Sept.

A method is presented by which the Ge in tissues and excreta may be determined by radiochemical counting of Ge^{71}. Studies of the distribution and excretion of radiogermanium oxide in the rabbit and the dog indicate that this compound is rapidly eliminated, chiefly by way of the urine. No selective tissue localization occurred. Studies of both stable and radioactive particulate Ge preparations indicate that the organism can easily dissolve finely divided elemental Ge and rapidly eliminate it, probably as the oxide. Ge oxide appears to be pharmacologically inactive. Because of the low energy (9 kv) of the radioactive form Ge^{71}, the biological effectiveness of this isotope is not significant. (auth)

62
AUTORADIOGRAPHIC STUDIES OF THE DEPOSITION OF SR^{89} IN RABBIT BONES. Barbara Kidman, Barbara Rayner, Margaret L. Tutt, and Janet M. Vaughan. J. Path. Bact. 64, 453-9(1952) July.

The autoradiographic picture in the long bones of rabbits of different ages killed at different times after an injection of Sr^{89} is described. In young animals particularly, Sr^{89} is concentrated in certain areas of bone. Such areas are therefore liable to considerably greater radiation damage than an estimation of the amount retained per unit weight of the skeleton, assuming an even distribution, might suggest. Strontium is concentrated in areas where active bone formation is taking place at the time of injection. Such localized areas are subsequently displaced by the formation of new nonradioactive bone and may finally be removed by the normal process of resorption. The localization of certain isotopes in areas of active bone growth, as well as their more diffuse distribution throughout mineralized bone, suggests that ionic exchanges on the surface of bone crystals alone will not account for the uptake of these isotopes. (auth)

63
RADIOCONTAMINANTS IN BIOLOGICAL STUDIES WITH COPPER-64. W. Joe Frierson, Sam L. Hood, Ira B. Whitney, and C. L. Comar. Arch. Biochem and Biophys. 38, 397-404(1952) July.

In Cu tracer studies the radioactivity in the urine of animals had a longer half life than the original Cu^{64}, indicating the presence and concentration of other radioactive nuclides. Paper chromatography and chemical fractionations of solutions of the irradiated Cu unit separated and identified two major radiochemical impurities, Zn^{65} and Ag^{110}, and indicated the presence of Zn^{69}, Fe^{59}, and possibly others. The type and concentration of contaminants is variable. Electrolytic purification of the Cu is feasible. The presence of radiocontaminants at the observed levels is of importance in activity measurement when there is chemical or biological concentration of the impurity relative to the nuclide being studied or when the principal nuclide has a shorter half life so that the impurity contributes relatively more as time passes. (auth)

64
A HYDRODYNAMIC MODEL OF ISOTOPE DISTRIBUTION IN LIVING ORGANISMS. D. B. Zilversmit and Moris L. Shore. Nucleonics 10, No. 10, 32-4(1952) Oct.

In 3- or 4-compartment metabolic systems, mathematical analysis of the quantitative relationships between the specific activities of the metabolites and their turnover rates becomes very difficult. The investigator can then resort to a hydrodynamic model and study the concentration-time relations in each compartment by varying exchange rates one at a time. A discussion of this technique and some experimental results are given. (L.M.T.)

CHEMISTRY

65
Pennsylvania State Coll. School of Chemistry and Physics
STUDIES ON COORDINATION COMPOUNDS: VIII. SOME FACTORS CONCERNING THE EFFECT OF THE TERMINAL GROUPS ON THE CHELATING ABILITIES OF BETA-DIKETONES. IX. THE SOLUTION STABILITIES OF THE CHELATE COMPOUNDS OF A NUMBER OF ORGANIC LIGANDS. X. A CORRELATION OF THE SOLUTION STABILITIES OF THE CHELATE COMPOUNDS OF LIGANDS COORDINATING THROUGH NITROGEN AND OXYGEN, by LeGrand G. Van Uitert and W. Conard Fernelius. Aug. 11, 1952. 53p. (NYO-3630)

The chelate-compound formation constants for $NiCl_2$, and $Ce(ClO_4)$, with several β-diketones in 75 vol. % dioxane–25 vol. % water solution are reported. Graphical representations of the logarithms of the formation constants of the chelate compounds as a function of the acid dissociation constants of the β-diketones show a subdivision of the compounds studied into four groups. The chelate compound species formed in solution by several chelating agents coordinating through oxygen, nitrogen, and combinations of the two in water-dioxane mixtures are discussed and their stability constants determined for 75 vol. % dioxane solutions. The correlation of the stability constants of ligands coordinating through oxygen and nitrogen in aqueous solution serve to demonstrate the general factors involved in coordination chemistry. This correlation can be effected through consideration of the electronegativities and the bond-hybrid states of the partners, the inductive influences involved, and the number of coordinating positions on the ligand. (auth)

66
Radiation Lab., Univ. of Calif., Berkeley
VAPORIZATION OF ALKALI METAL OXIDES, by Leo Brewer and John Margrave. July 1, 1952. 25p. (UCRL-1864)

Since the vaporization of metal oxides at high temperatures may occur according to three general types of reactions, the determination as to which reaction group is the proper one for a given oxide may be accomplished by a combination of experimental and thermodynamic procedures. It is necessary to measure experimentally the vapor pressure over the compound. In these experiments the vaporization of Li_2O and Na_2O was studied by the Knudsen method, in which the weight of material effusing from a round hole of known diameter in an otherwise closed container at a given temperature was measured over a known period of time. The problem in thermodynamics is the correlation of the measured weight losses with one of the possible methods of vaporization. The vaporization of Li_2O was observed from 1532 to 1669°K and that of Na_2O from 918 to 1467°K. (L.T.W.)

67
A COMPARISON OF THE MAGNITUDES OF THE ISOTOPE INTERMOLECULAR EFFECTS IN THE DECARBOXYLATIONS OF MALONIC-1-C^{14} ACID AND MALONIC-2-C^{14} ACID AT 154°. Gus A. Ropp and Vernon F. Raaen. J. Am. Chem. Soc. 74, 4992-4(1952) Oct. 20.

By a method involving measurement of the rate of change with time of the logarithm of the specific activity of unchanged malonic acid, the isotope effect, k_{14}/k_{12}, in the decarboxylation of malonic-2-C^{14} acid at 154°C has been shown to have a value of 0.929. For decarboxylation of malonic-1-C^{14} acid under the same conditions the value of k'_{14}/k_{12} was found to be 0.939. (auth)

68
PREPARATION OF VANADIUM MONOXIDE. Mikkel Frandsen. J. Am. Chem. Soc. 74, 5046(1952) Oct. 20.

A compressed, intimate mixture of V_2O_3 and finely divided V is heated in a vacuum at 1750°C for 1 hr. Evidences of conversion are changes in physical and chemical properties, chemical analysis, and x-ray examination. VO has a specific gravity of 5.55 (25°/4), hardness 8 to 9 on the Mohs scale, and a medium gray color. It dissolves slowly in hot dilute HCl, forming a violet or blue solution; HF acts faster, and HNO_3 dissolves it readily under evolution of nitric oxide. (auth)

69

VAPOR PRESSURE OF THORIUM OXIDE FROM 2050 TO 2250°K. Edward Shapiro. J. Am. Chem. Soc. 74, 5233-5 (1952) Oct. 20.

The vapor pressure of ThO_2 was found by determining its vacuum evaporation rate from coated W filaments by direct weight-loss measurements. A straight-line equation, log $p_{mm} = 3.71 \times 10^4/T + 11.53$, was obtained. The vapor pressure at 2000°K is 10^{-7} mm, which is much lower than the value 3×10^{-3} mm given by Born (Z. Electrochem. 31, 309 (1925)). The slope of the line corresponds to a heat of vaporization of 171 kcal/mole. (G.Y.)

70

RELATIVE RATES OF HYDROLYSIS OF UREA CONTAINING C^{14}, C^{13} AND C^{12}. John A. Schmitt, Albert L. Myerson and Farrington Daniels. J. Phys. Chem. 56, 917-20(1952) Oct.

Urea containing C^{12}, C^{13} and C^{14} was hydrolyzed in the presence of urease. The relative rates of reaction were followed by the mass-spectrometric analysis of the carbon dioxide which was evolved at successive time intervals. The heavier isotopes react more slowly, the C^{13} accumulating in the last fraction to decompose, and the C^{14} accumulating still more in accordance with the following ratios of the rate constants: $k_{C^{12}\text{-urea}} / k_{C^{13}\text{-urea}} = 1.010 \pm 0.001$; and $k_{C^{12}\text{-urea}} / k_{C^{14}\text{-urea}} = 1.032 \pm 0.002$. (auth)

71

REMARK ON THE WORK OF E. HAYEK, TH. REHNER, AND A. FRANK: HALOGENIDES OF DI- AND TRIVALENT THORIUM. P. W. Schenk. Monatsh. 83, 1011-13(1952) Aug. 15. (In German)

After preparing and studying the properties of lower-valent compounds of Th, Hayek et al. (NSA 5-6647) stated that Th should not, from its chemical properties, be considered as the first member of the actinide group. The present paper points out several chemical inconsistencies involved in grouping Th, Pa, and U under their apparent homologs Hf, Ta, and W. Arrangement of the elements by their atomic structure is preferred. (G.Y.)

72

ISOTOPIC EXCHANGE REACTIONS OF CHROMIUM(III) COMPLEXES. William R. King, Jr. and Clifford S. Garner. J. Am. Chem. Soc. 74, 5534-6(1952) Nov. 5.

Exchange of Cr^{51} between hexaaquochromium(III) ion and three Cr(III) complexes, tris-(ethylenediamine)-chromium(III) ion, hexakis-(urea)-chromium(III) ion, and the neutral complex, trifluorotriaquochromium(III), has been investigated in nitric acid solutions. The results suggest that the three complexes would be suitable compounds for the Szilard-Chalmers recoil separation of radioactive Cr. (G.Y.)

73

EFFECT OF ISOTOPE SUBSTITUTION ON ORGANIC REACTION RATES. Gus A. Ropp. Nucleonics 10, No. 10, 22-7 (1952) Oct.

A review is given of the effect on the organic reaction rate caused by the substitution of one isotope of C, N, or O for another. Intermolecular and intramolecular isotope effects of various organic reactions are given for C^{13}, C^{14}, N^{15} and O^{18} in terms of the specific reaction rate of the normal molecule and the specific rate of the labeled molecule, both experimental and theoretical values. Data also include reactions in which no isotope effect was found. 50 references. (L.M.T.)

74

EFFECT OF ISOTOPIC SUBSTITUTION ON THE COLLISION PROPERTIES OF THE CARBON DIOXIDE MOLECULE. E. W. Becker and W. Beyrich. J. Phys. Chem. 56, 911-13(1952) Oct.

For quantum mechanical reasons symmetric and unsymmetric isotopic substitutions are expected to have different effects on the collision properties and reaction rates of molecules. Therefore the collision properties of symmetrically and unsymmetrically substituted CO_2 molecules have been investigated by means of the thermal-diffusion method. A difference of 78° was found between the thermal-diffusion reversing temperatures of the pairs $O^{16}C^{13}O^{16}/O^{16}C^{12}O^{16}$ and $O^{16}C^{12}O^{17}/O^{16}C^{12}O^{16}$, the partners of the common $O^{16}C^{12}O^{16}$ being equal in mass but different in symmetry. The difference cannot be explained on a classical basis and may be due to the quantum-mechanical symmetry effect expected from theory. At any rate the experiments show that the collision properties of a molecule can jump with an isotopic substitution, the change in these properties being nearly independent of the relative change in mass. A further experiment is suggested to decide whether nuclear isomers are identical particles in the quantum mechanical sense. (auth)

75

INORGANIC COMPLEX COMPOUNDS CONTAINING POLYDENTATE GROUPS. VIII. ZIRCONIUM(IV) COMPLEXES WITH 2-NITROSO-1-NAPHTHOL. Hans B. Jonassen and Winston R. DeMonsabert. J. Am. Chem. Soc. 74, 5298-301 (1952) Nov. 5.

The complexes formed between 2-nitroso-1-naphthol and Zr(IV) have been investigated in mixtures of water and ethanol and water and dioxane in the absence and presence of $HClO_4$. It has been found that in the absence of $HClO_4$ a one-to-one complex forms, whereas in solutions 3M or larger in $HClO_4$ and 3×10^{-3}M Zr(IV) a one-to-four complex is formed. The pK instability values have been determined: for the one-to-one complex in ethanol-water it is 3.7 and for the one-to-four complex in 50% dioxane-water it is 11.6. (auth)

ANALYTICAL PROCEDURES

76

[Armour Research Foundation]

ANALYSIS OF ZIRCONIUM ALLOYS. [nd] Decl. with deletions Oct. 28, 1952. 5p. (AECD-3457)

The problems associated with the dissolution of Zr-Sn and Zr-Cr alloys were satisfactorily overcome by use of equal parts of fluoboric and 1-1 sulfuric acids. The Sn and Cr contents were then determined by conventional volumetric procedures. (L.M.T.)

77

Ames Lab.

DIFFERENTIAL TITRATION OF AMINES, by James S. Fritz. [nd] 20p. (ISC-269)

Although several excellent procedures are available for the acidimetric titration of amines in nonaqueous solutions, none of these permit the differential titration of amines of different basic strength. This paper discusses the theory of such titrations and proposes simple potentiometric and indicator methods for differential titrations in nonaqueous solvents. These methods permit analysis of aromatic-aliphatic amine mixtures and certain other mixtures such as aniline – o-chloroaniline, pyridine-caffeine and aniline-sulfathiazole. Preliminary treatment with salicylaldehyde permits the determination of both primary and secondary aliphatic amines by a single titration. These general methods

should find application in the analysis of a large number of specific amine mixtures. (auth)

78

Department of Mines and Technical Surveys, Mines Branch, Ottawa (Canada)

THE DETERMINATION OF ALUMINUM; FLUOROPHOTOMETRIC METHOD, by J. B. Zimmerman. Oct. 21, 1952. 11p. (NP-4182; TR-104/52)

A method is described for determining aluminum in ores, solutions and alloys by means of the fluorescence of aluminum 8-hydroxyquinolate in chloroform at pH 4.6. The method has a wide range, using a dilution technique. Values from 0.001% Al to 99% Al have been determined. The accuracy is approximately ±5% which is better than that of existing methods for low grade samples. (auth)

79

Carbide and Carbon Chemicals Co. (Y-12)

DETERMINATION OF AMMONIA AND NITRATE NITROGEN PRESENT IN URANYL SULFATE AND URANIUM OXIDES, by W. B. Wright, Jr. Nov. 23, 1951. 20p. (Y-919)

Nitrogen present as ammonia and nitrates in uranyl sulfate and in uranium oxides may be determined with satisfactory accuracy and precision by the method described. Nitrates are reduced to ammonia by Devarda's alloy, then the free ammonia is removed by distillation in a modified micro-Kjeldahl unit and determined spectrophotometrically with a modified Nessler's reagent. Variables which affect the accuracy and precision are discussed and compared with previously reported results. Nitrates and ammonia in uranium metal may also be determined by the method. With microgram quantities of nitrogen the limit of error is less than ten per cent. (auth)

80

THE DETERMINATION OF NICKEL AND MANGANESE IN URANIUM. J. Haslam, F. R. Russell, and N. T. Wilkinson. Analyst, 77, 464-7(1952) Sept.

Methods have been developed for the determination of 0 to 0.02% of nickel, and 0 to 1.0% of manganese in uranium metal. The method for manganese depends on solution of the sample in nitric acid, and separation of silica by dehydration of the solution in the presence of hydrochloric acid. In the determination of nickel the sample is dissolved in nitric acid, which is subsequently removed by evaporation in the presence of sulfuric acid. In the nickel determination, metals that form insoluble sulfides are separated directly in the diluted sulfuric acid solution, and, in the manganese determination, after the separation of silica. The filtrate from the sulfide precipitation is boiled until free from hydrogen sulfide, and the nickel and manganese precipitated in the presence of iron by sodium carbonate. Precautions are taken to ensure complete precipitation of the nickel and manganese by decomposition of any bicarbonate by boiling. The mixed precipitate is filtered and washed with dilute sodium carbonate solution. The precipitate is then dissolved in acid and the nickel determined colorimetrically by the hypobromite–dimethylglyoxime method. Manganese is determined volumetrically with standard ferrous ammonium sulfate on a solution of the precipitate obtained in the same manner as for nickel after oxidation to permanganate. (auth)

81

THE ABSORPTIOMETRIC DETERMINATION OF ZIRCONIUM BY MEANS OF ALIZARIN-S WITH SPECIAL REFERENCE TO MAGNESIUM ALLOYS. A. Mayer and G. Bradshaw. Analyst, 77, 476-83(1952) Sept.

It is shown that the colored reaction product of zirconyl ions and alizarin sulfonate is of definite composition and stable in acid solution. The reaction is almost specific for Zr and can be used for its determination in Mg alloys, iron and steel, and minerals. A rapid method for determining the approximate composition of Hf-Zr salt mixtures is also indicated. The method compares favorably in accuracy, speed, and cost with the standard gravimetric procedure. (auth)

82

ASSAY OF SAMPLES DOUBLY LABELED WITH RADIOACTIVE HYDROGEN AND CARBON. Max W. Biggs, David Kritchevsky, and Martha R. Kirk. Anal. Chem. 24, 223 (1952) Jan.

Simultaneous activities of C^{14} and H^3 were obtained from a single cholesterol sample combustion by means of the apparatus and procedures described. The H^3 assay featured the reaction of $LiAlH_4$ with tritium oxide, formed during the combustion, for the generation of H^3, the activity of which was determined by a vibrating-reed electrometer. The $C^{14}O_2$ generated during the combustion was collected in NaOH solution and precipitated as $Ba(C^{14}O_3)_2$, which, after drying, was plated on Al disks and the activity measured by a Nucleometer window-type counter. (L.M.T.)

83

THE COLOUR REACTIONS OF CHLORANILIC ACID WITH PARTICULAR REFERENCE TO THE ESTIMATION OF CALCIUM AND ZIRCONIUM. R. E. U. Frost-Jones and J. T. Yardley. Analyst 77, 468-72(1952) Sept.

The color reactions of chloranilic acid are studied in some detail and with particular reference to interference in the colorimetric estimation of calcium and zirconium. A method is described for canceling interference by sodium, and a detailed procedure is described for estimating zirconium in the presence of a number of other ions. The influence of the perchloric acid concentration on the determination is discussed. (auth)

84

DETERMINATION OF MICROGRAM QUANTITIES OF THORIUM IN WATER; EXTENSION OF COLORIMETRIC METHOD. Albert E. Taylor and Richard T. Dillon. Anal. Chem. 24, 1624-5(1952) Oct.

A method is described for concentrating the Th present in water, preparatory to spectrophotometric determination of μg/ml quantities of Th. The disodium salt of 1-(o-arsonophenylazo)-2-naphthol-3,6-disulfonic acid was used to form a colored complex with the concentrated Th. The method is reported to be sensitive to less than 1×10^{-9} μg of Th in 1 g of water. (C.R.)

85

RAPID METHOD FOR PAPER CHROMATOGRAPHY OF ORGANIC ACIDS. F. W. Denison, Jr. and E. F. Phares. Anal. Chem. 24, 1628-9(1952) Oct.

The chromatographic method described uses ether, acetic or formic acid, and water, and requires less than 2 hours for satisfactory development of the chromatogram. (C.R.)

CRYSTALLOGRAPHY AND CRYSTAL STRUCTURE

86

Ames Lab.

THE CRYSTAL STRUCTURE OF STRONTIUM HYDROXIDE OCTAHYDRATE, $Sr(OH)_2 \cdot 8H_2O$, by Harold G. Smith. Oct. 14, 1952. 17p. (ISC-281)

Strontium hydroxide octahydrate, $Sr(OH)_2 \cdot 8H_2O$, is tetragonal and $a_0 = 9.00 \pm 0.01$, $c_0 = 11.58 \pm 0.01$ A. The space group is D_{4h}^5-P4/ncc with four molecules per unit cell. The oxygen atoms of the water molecules occupy two sixteenfold sets of general positions related by a translation $\frac{1}{2}\frac{1}{2}0$. Each oxygen atom is hydrogen-bonded to at least three other oxygen atoms using all seventy-two hydrogens in hydrogen bond formation. It is impossible to determine whether the strontiums are in the set 000 or $00\frac{1}{4}$ by x-ray diffraction data alone. An argument is presented for placing the stron-

tiums in the set $00\frac{1}{4}$ which results in a square Archimedean antiprism coordination of water molecules. (auth)

87

Cornell Univ.

STRUCTURES OF FLUOROCARBONS, ELEMENTARY BORON, AND BORON COMPOUNDS, by J. L. Hoard. Oct. 1, 1952. 5p. (NYO-930)

Two different specimens of the needle-like tetragonal modification of boron not only give real variations in the pattern of integrated intensities but show measurable differences in lattice constants. Values of the c-axis for the two specimens, for instance, differ by about one per cent. A comparison of reflection amplitudes calculated from the "ideal" structure with observed amplitudes gives approximately equally good agreement with either set of experimental amplitudes. It seems most probable that the large holes in the "ideal" structure can be filled with extra boron atoms to a varying degree for different specimens. The fluorocarbon C_8F_{10} crystallizes at room temperature in the hexagonal system. The unit cell has a = 6.0, c = 11.2 A, and contains two molecules. All of the data obtainable, moreover, seem to require "rotation" of the molecules about the three-fold axis. (auth)

88

X-RAY STUDIES OF RARE EARTH OXIDE SYSTEMS. II. THE OXIDE SYSTEMS Ce^{IV}-Sm^{III}, Ce^{IV}-Gd^{III}, Ce^{IV}-Y^{III}, Pr^{IV}-Y^{III} AND Pr^{III}-Y^{III}. J. D. McCullough and J. D. Britton. J. Am. Chem. Soc. 74, 5225-7(1952) Oct. 20.

Lattice constants of solid solutions of trivalent Sm, Gd, and Y oxides in CeO_2 and of the Pr oxides–Y oxide systems are tabulated. An interesting feature is the gradual and continuous change from the f.c.c. fluorite structure of pure CeO_2 and PrO_2 to the "C" type b.c.c. structure of the trivalent rare earth oxides, shown best in the systems Ce^{IV}-Y^{III} and Pr^{IV}-Y^{III}. This effect is shown with decreasing tendency in going to the systems Ce^{IV}-Gd^{III} and Ce^{IV}-Sm^{III} and was not in evidence in the systems Ce^{IV}-Nd^{III} and Ce^{IV}-Pr^{III}, indicating that ordering of the vacant anion sites required by the "C" structure is favored by the trivalent ions of smaller radius. Only the Ce^{IV}-Gd^{III} system showed an indication of a limit in the present work. The inability of Pr to be oxidized beyond the tetravalent state in the Pr-Y system was noted. (G.Y.)

89

CRYSTAL STRUCTURE OF LANTHANUM NITRIDE. R. A. Young and W. T. Ziegler. J. Am. Chem. Soc. 74, 5251-3 (1952) Nov. 5.

La nitride has been prepared by direct combination between La metal and N_2 to yield a product having approximately the composition LaN. The crystal structure of LaN has been shown to be of the NaCl type, confirming the earlier work of Iandelli and Botti. The powder x-ray-diffraction patterns of LaN and face-centered cubic La metal have been shown to be demonstrably different. The dissociation pressure of LaN was found to be very small at 900°C. The LaN specimens gave no evidence of superconductivity down to 1.8°K. (auth)

DEUTERIUM AND DEUTERIUM COMPOUNDS

90

CALCULATED APPROXIMATE VALUES OF THE FREE ENERGY FUNCTION FOR THE OD MOLECULE. G. McDonald. J. Am. Chem. Soc. 74, 5539-40(1952) Nov. 5.

The following values for the free energy function of the OD molecule as a harmonic oscillator have been calculated. The values do not include the contribution due to nuclear spin.

Temp., °K	$(F^0-H^0_0)/T$ cal/°K/mole
1000	−46.87
1200	−48.15
1400	−49.24
1600	−50.20
1800	−51.06
2000	−51.83
2200	−52.53
2400	−53.18
2600	−53.79
2800	−54.35
3000	−54.88

(G.Y.)

91

SUBSTITUTION AND ELIMINATION RATE STUDIES ON SOME DEUTERO-ISOPROPYL BROMIDES. V. J. Shiner, Jr. J. Am. Chem. Soc. 74, 5285-8(1952) Nov. 5.

The rates of the bimolecular substitution and elimination reactions of α-deutero- and β-hexadeutero-isopropyl bromides in ~ 1N alcoholic sodium ethoxide have been determined. These are compared with the rates observed for ordinary isopropyl bromide. The substitution rate is the same for all three compounds. The elimination rate is the same for the ordinary and the α-deutero compounds while the β-deutero one eliminates more slowly than the protium analog by a factor of 6.7. It is concluded that these results are in full accord with the predictions of the familiar S_N2 and E2 mechanisms. (auth)

FLUORINE AND FLUORINE COMPOUNDS

92

Atomic Energy Project, Univ. of Rochester

A BIBLIOGRAPHY OF THE LITERATURE (1936-1952) ON THE PHARMACOLOGY AND TOXICOLOGY OF FLUORINE AND ITS COMPOUNDS, INCLUDING EFFECTS ON BONES AND TEETH, by Frank A. Smith and G. J. Cox. Sept. 26, 1952. 186p. (UR-154(rev.))

A survey was made of the literature published from 1936 to 1952 on the pharmacology, toxicology and metabolism of fluorine and its compounds. A list of 2449 references is presented. (C.R.)

93

ELECTRODE POTENTIALS IN LIQUID HYDROGEN FLUORIDE. George G. Koerber and Thomas De Vries. J. Am. Chem. Soc. 74, 5008-11(1952) Oct. 20.

The values of the electromotive force of cells of the type $M,MF_2(s)/HF(NaF)/Hg_2F_2(s)/Hg$ where M represents cadmium, copper, or lead were found at 10 and 0°C. These were used to evaluate the standard free energies of formation of mercurous, cupric and lead fluorides. A study of the vapor pressures of the systems mercurous fluoride–hydrogen fluoride, cadmium fluoride–hydrogen fluoride, and lead fluoride–hydrogen fluoride was made at 0°C. Lead fluoride was found to form an addition compound with hydrogen fluoride with the formula $PbF_2 \cdot 2\frac{1}{2}HF$. The cell $Hg,Hg_2F_2(s)/NaF(in\ HF)//NaF, H_3OF,AgF(in\ HF)/Ag$ was studied at 0°C over a range of concentrations of the electrolytes. The data from this were used to calculate activity coefficients of silver fluoride in liquid hydrogen fluoride. An ion size parameter of 1.9 A was found for silver fluoride in the solutions studied. The standard free energy of formation of AgF·HF from silver, fluoride, and hydrogen fluoride was calculated. (auth)

94

PERFLUORINATED CYCLIC ETHERS. Albert L. Henne and Sidney B. Richter. J. Am. Chem. Soc. 74, 5420-2(1952) Nov. 5.

$\overline{CF_2CF_2\text{-}O\text{-}CF_2CF_2}$ and $\overline{CF_2CF_2CF_2\text{-}O\text{-}CF_2CF_2}$ were synthesized and found incapable of dissolving Lewis acids. The lack of basic properties already shown in perfluorinated open chain ethers is therefore not due to steric hindrance, and is attributed to electronegative induction. (auth)

95

THE CHEMISTRY OF THE PERFLUORO ACIDS AND THEIR DERIVATIVES. III. THE PERFLUORO ALDEHYDES. Donald R. Husted and Arthur H. Ahlbrecht. J. Am. Chem. Soc. 74, 5422-6(1952) Nov. 5.

Perfluoro aldehydes and the corresponding aldehydrols have been prepared by a new synthetic method, namely, $LiAlH_4$ reduction of the perfluoro acid. The Rosenmund reaction has also been used to prepare perfluoro aldehydes from the corresponding perfluoro acid chlorides. The chemistry of the perfluoro aldehydes has been studied and 2,4-dinitrophenylhydrazones and diacyl derivatives prepared. (auth)

96

PURE CHROMYL FLUORIDE. Alfred Engelbrecht and Aristid V. Grosse. J. Am. Chem. Soc. 74, 5262-4(1952) Nov. 5.

Pure chromyl fluoride, CrO_2F_2, was isolated for the first time by means of a vacuum apparatus built out of copper, silica-free glass and Kel-F tubing. The violet-red crystals reach a pressure of 760 mm at 29.6°C and melt to an orange-red liquid at 31.6°C; the vapor pressure at the triple point equals 885 mm. The compound was prepared from CrO_3 and anhydrous HF; its solubility in HF is very low at −78°C. The purification made use of the fact that it forms stable, non-volatile triple addition compounds with HF and KF (or NaF). The fluoride is extremely reactive, particularly with any type of oxidizable organic compound. (auth)

GRAPHITE

97

STUDIES IN GRAPHITE AND RELATED COMPOUNDS. I. ELECTRONIC BAND STRUCTURE IN GRAPHITE. C. A. Coulson and R. Taylor. Proc. Phys. Soc. (London) A65, 815-25(1952) Oct. 1.

The Bloch (tight-binding) approximation is applied to a study of graphite. The mean energy per atom and the internuclear distance are calculated in good agreement with experiment. Previous accounts are extended by including certain overlap integrals and by dealing with a set of parallel layer planes instead of only one plane. The shape of the band due to the π electrons is calculated, and the experimental x-ray-emission spectrum of graphite is interpreted. It is concluded that the role of σ electrons is greater than is often supposed. (auth)

98

STUDIES IN GRAPHITE AND RELATED COMPOUNDS. II. MOMENTUM DISTRIBUTION IN GRAPHITE. W. E. Duncanson and C. A. Coulson. Proc. Phys. Soc. (London) A65, 825-33(1952) Oct. 1.

The space wave functions for the π electrons in a graphite layer, as found in Part I, are transformed into momentum coordinates, and the radial distribution function, including σ electrons and π electrons, is calculated. Using the theory of Jauncey and DuMond the shape of the Compton profile in x-ray scattering is predicted. Both this and the momentum distribution are in excellent agreement with experimentally determined values. The introduction of a plausible scale factor in the atomic wave functions would make the agreement almost perfect. (auth)

99

STUDIES IN GRAPHITE AND RELATED COMPOUNDS. III. ELECTRONIC BAND STRUCTURE IN BORON NITRIDE. R. Taylor and C. A. Coulson. Proc. Phys. Soc. (London) A65, 834-8(1952) Oct. 1.

An analysis is made of the distribution of π electrons in the crystal of boron nitride. The insulating character of this substance is shown by the fact that these electrons completely occupy one band, of width approximately 2.4 ev, separated from the next higher band by a gap of about 4.6 ev. The density of states in the band is calculated accurately for a single layer plane, and approximately for the three-dimensional crystal. Until the energies of the σ electrons are better known, further progress in understanding this substance will be difficult. (auth)

LABORATORIES AND EQUIPMENT

100

Atomic Energy Research Establishment, Harwell, Berks (England)

A SIMPLE AIR EJECTOR AS A SUCTION MOTOR FOR DRY BOXES, by J. R. Catlin, L. Coward, D. Darling, W. T. Spragg, and C. G. Webb, and APPENDIX: A DESIGN FOR THE MANUFACTURE OF AN AIR EJECTOR FROM STANDARD COPPER ALLOY PIPE FITTINGS FOR OBTAINING REDUCED PRESSURE IN DRY BOXES, by P. G. Reynolds. 1952. 12p. (AERE-C/M-152)

The use of a simple adjustable air ejector made of glass tubing as a means of providing suction to dry boxes is described. Experimental work to determine the maximum rate of flow for minimum pressure applied resulted in an ejector which gives satisfactory performance. Superiority of the air-ejector system over the use of blower motors is discussed. An appendix presents a design for a similar ejector made of standard Cu-alloy pipe fittings. The ejector gives a suction of 10 in. water gage when the compressed air supply is at approximately 10 psi. (C.R.)

101

Atomic Energy Project, Univ. of Calif., Los Angeles

A NEW EXPOSURE CHAMBER FOR INHALATION STUDIES, by L. Baurmash, F. A. Bryan, R. Dickinson, and W. C. Burke, Jr. Issued Oct. 22, 1952. 18p. (UCLA-231)

An inhalation chamber of new design has been developed for use in the study of the effect of air-borne contaminants. The chamber is designed for ease of animal handling, chamber cleaning, and decontamination. The unit is also of such design that there are no "dead" spots in the chamber. The feed maintains a uniform concentration with a maximum of 4.3% variation. The concentration can be varied to meet the requirements of the experiment. Although the chamber was not originally developed for use in radioactive contaminant study, its design readily allows active materials to be used. (auth)

MOLECULAR STRUCTURE

102

Fordham Univ.

THE DIPOLE MOMENT OF THIOACETOACETIC ESTER IN SOLUTION, by J. J. Draney, C. F. Ferraro, and M. Cefola. [nd] 17p. (NYO-724)

The dielectric constants and densities of solutions of thioacetoacetic ester in benzene, hexane, CCl_4, and CS_2 and of o-mercaptomethylbenzoate in benzene were measured at 25°C. The values of the molar polarization of the solutes at infinite dilution were calculated. The apparent dipole moments of the two solutes in Debye units were calculated by the Debye equation $\mu = 0.01273\sqrt{(_\infty P_2 - P_D)T}$, where $_\infty P$ = the molar polarization of the solutes at infinite dilution, P_D = the distortion polarization of the solute, and T = the molar refraction for the NaD line. These measurements

furnish information concerning the structure of the molecules under consideration. (L.T.W.)

RADIATION CHEMISTRY

103

THE STATE OF CHEMICAL COMBINATION OF IODINE^{131} FORMED BY NEUTRON IRRADIATION OF TELLURIUM IN ORGANIC LIQUIDS. F. J. Keneshea, Jr. and Milton Kahn. J. Am. Chem. Soc. 74, 5254-5(1952) Nov. 5.

An investigation has been made of the chemical forms assumed by I^{131} produced through β decay of 25-min Te^{131} in organic liquids. The Te^{131} was produced by irradiation of solutions of Te tetrachloride in the thermal column of a Los Alamos reactor. About 87% of the I^{131} activity produced in benzene was in a form extractable with aqueous solutions; the remaining 13% was in the form of organic-I^{131} compounds; 10% in a form chemically indistinguishable from iodobenzene and 3% as higher-boiling compounds. Addition of chlorobenzene, iodobenzene, or carbon tetrachloride to benzene solutions of Te tetrachloride before irradiation caused an increase in the yield of organic-I^{131} compounds. The yield of radioactive iodobenzene increased to 40% in pure chlorobenzene and 30% in pure iodobenzene. A method for the production of radioactive iodobenzene of high specific activity has been developed. (auth)

104

DISTRIBUTION OF ALPHA RAY ENERGY IN RADIATION CHEMISTRY. S. C. Lind. J. Phys. Chem. 56, 920(1952) Oct.

Yield of acetylene polymerization in alpha-particle bombardment of mixtures containing inert gases is proportional to the number of ions produced by the irradiation. Such excited atoms or molecules as are primarily produced by the bombardment apparently make no significant contribution to the yield. (auth)

RADIATION EFFECTS

105

Engineering Research Inst., Univ. of Mich.

PROGRESS REPORT 3 [ON] UTILIZATION OF THE GROSS FISSION PRODUCTS, by L. E. Brownell, L. C. Anderson, H. J. Gomberg, J. J. Martin, W. W. Meinke, R. B. Morrison, L. Thomassen, G. J. Van Wylen, E. T. Vincent, and R. A. Wolfe. June 1952. 103p. (COO-91)

Data from a study of the effects of ionizing radiation on combustion engine performance indicate that β radiation has little effect on combustion conducted at less than atmospheric pressure. The study of the effects of β radiation on the polymerization of styrene and natural oils has been continued and data are included. In a study of the effects of radiation sterilization on foods, it was found that green vegetables may be irradiated without undesirable flavor changes, while products containing animal proteins generally undergo undesirable changes in flavor as a result of γ radiation. Small amounts of chemical additives prevented undesirable flavor changes in fresh meat. Data on the protective effects of enzyme concentration, cystine and Na pyruvate on enzymatic activity following γ irradiation and from preliminary studies of the effects of γ radiation on microorganisms, viruses, bacteria, pharmaceuticals, antibodies, and antibiotics are included. The possibilities of using γ radiation for the sterilization of blood and blood products, and the importance of sterilization in the control of serum hepatitis, are discussed. Three types of glass which meet the requirements for ampules and containers of pharmaceuticals were tested for the effects of radiation on color of the glass. The feasibility of using Sr^{90} as a β source is discussed and tests are reported on ceramic glazes containing it conducted at room temperature and at high temperature. At low temperature the ceramic glazes retain the radioactive Sr^{90}, but additional experiments will be required to develop satisfactory glazes for high-temperature service. Calibration of 1000-c Co^{60} γ-ray source and proposals for design of a new Co^{60} source are discussed. (C.R.)

106

DECOMPOSITION OF CYSTINE BY IRRADIATION OF ITS AQUEOUS SOLUTIONS. Mary Rotheram, Norman Todd, and S. L. Whitcher. Naturwissenschaften 39, 450-1(1952) Oct. (In English)

Cystine was dissolved in small amounts of 2N H_2SO_4 and diluted to 0.0002M with specially purified water. The solutions were irradiated with 250-kvp x rays up to 76×10^{-20} ev/liter energy absorption. Disappearance of part of the cystine accompanied by formation of H_2O_2 was observed. The extent of the attack varied somewhat with the pH, and a maximum and minimum were found at nearly the same positions on the pH scale as with cysteine. Removal of dissolved air did not alter appreciably the amount of cystine destruction, but there was no H_2O_2 formed in the deaerated solutions. There was no reduction to cysteine and no formation of sulfide or sulfate, but no evidence was found to exclude a partial breakdown of the cystine molecule into smaller fragments. Formation of cystine disulfoxide as the first oxidation product is indicated. (G.Y.)

RARE EARTHS AND RARE-EARTH COMPOUNDS

107

Ames Lab.

THE STABILITY OF THE RARE EARTH COMPLEXES WITH ETHYLENEDIAMINE-TETRAACETIC ACID, by E. W. Wheelwright, F. H. Spedding, and G. Schwarzenbach. Oct. 8, 1952. 25p. (ISC-279)

Because of the small tendency of the rare-earth cations to form complexes, very little quantitative data have been obtained. It is known, however, that the rare earths form rather stable complexes with the anion of ethylenediaminetetraacetic acid, written as H_4Y in the report. In order to obtain the stability constants of these complexes, the equilibrium between the complex CuY^{-2}, uncomplexed ions Cu^{+2}, and the rare-earth complex MY^{-1} in the presence of uncomplexed rare-earth ion M^{+3} was investigated. From the stability constant of the Cu complex, the constant for the rare-earth complex is calculated as $K_{MY} = [MY]/[M] \times [Y]$ where the brackets denote concentrations. All data obtained are valid for an aqueous salt solution of ionic strength $\mu = 0.1$ and a temp. of 20°C. (auth)

108

Radiation Lab., Univ. of Calif., Berkeley

THE THERMODYNAMICS OF THE RARE EARTH OXIDES, by Leo Brewer. Sept. 1952. 6p. (UCRL-1931)

A revision is made of the previous compilation of the heats of formation of nine of the rare-earth oxides in order to obtain better agreement and self-consistency among the various data. A tabulation is given of the heats and free energies of formation in kcal per atom of O for the stable modification at 298°K and the entropy of formation is given in calories per degree per atom of O.

SEPARATION PROCEDURES

109

Pittsburgh Univ.

ACETYLACETONE IN THE DUAL ROLE OF SOLVENT AND REAGENT IN EXTRACTION OF METAL CHELATES, by John F. Steinbach and Henry Freiser. Issued Oct. 3, 1952. 18p. (NYO-3070)

The use and advantages of acetylacetone serving as both solvent and chelating reagent in the extraction of metal solutions are discussed and exemplified through construc-

tion of extraction curves for the divalent ions, copper, beryllium, and zinc. That acetylacetone may be profitably used in continuous extraction processes involving macro amounts of metal has been demonstrated by the separation of copper and zinc. Using data from extraction curves, the over-all formation constants of the chelate may be obtained. Formation constants for beryllium and copper acetylacetonates were obtained and found to agree satisfactorily with those determined using a different method. (auth)

110

Syracuse Univ.

A. COPRECIPITATION FROM HOMOGENEOUS SOLUTION; B. ANALYTICAL CHEMISTRY OF THORIUM FOR PERIOD SEPTEMBER 1, 1951, TO JUNE 2, 1952, by Louis Gordon. June 1, 1952. 35p. (NYO-3186)

Studies have been initiated with several carriers to be used in studying coprecipitation from homogeneous solution. These include barium sulfate, silver chloride, basic stannic sulfate, and beryllium ammonium arsenate. Methods presently available for the precipitation from homogeneous solution of barium sulfate and basic stannic sulfate are being utilized in studying the coprecipitation of strontium and manganese(II), respectively. Since a method for this mode of precipitation was not available in the case of silver chloride, a procedure was developed and the coprecipitation of thallium(I) is being studied. Another procedure, for the precipitation of beryllium ammonium arsenate in the presence of ethylenediaminetetraacetic acid, is being developed in order to study the coprecipitation of iron(III). Absorption and flame spectrophotometric and polarographic methods are the only methods which have been used thus far in determining the distribution of substances between carrier and solution with the use of radioactive tracers projected in the very near future. The data which have been collected thus far are too sparse for the purpose of testing either the Berthelot-Nernst (homogeneous) or the Doerner and Hoskins (heterogeneous) distribution laws.

An amperometric titration for thorium in the presence of the rare earths has been developed. Ammonium molybdate is used as titrant for mixtures of thorium and rare earth chlorides in 2.5N sodium chloride as supporting electrolyte. The present rapid procedure determines 10 to 30 mg of thorium oxide in the presence of up to 175 mg of rare earth oxides. (auth)

111

ENRICHMENT OF ISOTOPES BY DIFFERENCE IN RATES FOR IRREVERSIBLE ISOTOPIC REACTIONS. Richard B. Bernstein. J. Phys. Chem. 56, 893-6(1952) Oct.

The feasibility and usefulness of achieving amplification of the difference in isotopic abundance measured in the course of a competitive isotopic reaction is pointed out. Amplification is accomplished by operating at high extent of reaction and measuring the isotope abundance of the unconverted substrate which is stripped of the lighter isotope by the equivalent of several stages of separation. The over-all separation $S = (k/k^*)^N$, where k/k^* is the ratio of isotopic rate constants and N the equivalent number of stages; $N = -\ln(1 - f)$, where f is the fraction of substrate reacted. Experimental data on the pyrolysis of nickel carbonyl in a flow system and malonic acid in a static system give semi-quantitative confirmation of this result. A continuous flow method of isotope enrichment is suggested in which the isotopic mixture flows through a reaction zone where preferential reaction occurs, thus concentrating the heavy isotope in the unconverted substrate which may be further enriched in subsequent stages of a cascade. The possible practicality of this approach is considered with the aid of a specific example. (auth)

112

THERMAL DECOMPOSITION OF $MeCl_4 \cdot 2C_6H_5COOR$ TYPE COMPOUNDS. F. W. Chapman, W. S. Hummers, S. Y. Tyree and S. Yolles. J. Am. Chem. Soc. 74, 5277-9(1952) Nov. 5.

Zr tetrachloride·2-methyl benzoate, Zr tetrachloride·2-ethyl benzoate, and the analogous ester addition compounds of Hf tetrachloride undergo thermal decomposition to yield alkyl chloride and metal benzoate. Superimposed on this reaction, free metal chloride reacts with metal benzoate to form benzoyl chloride and oxygen-bridge polymers. Indications are that pure Hf addition compounds decompose at a slower rate than the corresponding Zr compounds. Residues from decompositions that are carried to completion are resin-like solids insoluble in all common solvents except concentrated sulfuric acid. (auth)

SPECTROSCOPY

113

Oklahoma Univ.

INFRARED AND RAMAN SPECTRA OF FLUORINATED ETHANES. V. THE SERIES CF_3CF_3, CF_3CF_2Cl, CF_3CFCl_2, AND CF_3CCl_3, by J. Rud Nielsen, C. Y. Liang, and R. M. Smith, Oklahoma Univ. and D. C. Smith, Naval Research Lab. [nd] 23p. (ORO-81)

The infrared spectra of CF_3CF_2Cl, CF_3CFCl_2 and CF_3CCl_3 vapors have been obtained in the region from 2 to 38μ, and the spectra of liquid CF_3CF_2Cl and CF_3CFCl_2 in the region from 2 to 22μ, with the aid of LiF, NaCl, KBr, and KRS-5 prisms. The Raman spectra of all three compounds in the liquid state, and of gaseous CF_3CF_2Cl, were studied with a three-prism glass spectrograph of linear dispersion 15 A/mm at 4358 A. Depolarization ratios were determined for most of the raman bands. All fundamental vibration frequencies except the lowest (torsional) have been assigned for each molecule, and the observed spectra have been interpreted in detail. (auth)

114

Geological Survey

THE EFFECT OF ASHING TEMPERATURES ON THE VOLATILITY OF GERMANIUM IN LIGNITE SAMPLES, by Wendell P. Tucker and Claude L. Waring. Sept. 1952. 8p. (TEI-267)

A study has been conducted to provide data on the loss of Ge from ashed lignite samples. The lignite samples, of known Ge content, were ashed at various temperatures as high as 1000°C with varying rates of heating and varying amounts of surface area of the lignites. The results indicate that no Ge was volatilized during the various ignitions. (auth)

SYNTHESES

115

American Meat Inst. Foundation

INCORPORATION OF C^{14} TOTALLY LABELED NUCLEOSIDES INTO NUCLEIC ACIDS, by Irwin A. Rose and B. S. Schweigert. American Meat Inst. Foundation and Univ. of Chicago. [nd] 20p. (AECU-2276)

An investigation was made of the fate of the whole nucleoside in nucleic acid synthesis. The activity of nucleic acids synthesized from uniformly labeled nucleosides and nucleotides was examined to determine if the nucleoside is incorporated as an intact unit or suffers degradation at the nucleoside bond prior to incorporation. Nucleosides labeled with radiocarbon were prepared from Euglena grown in $C^{14}O_2$ and were shown to contain activity in both base and sugar moieties. Results are reported for experiments in

which cytidine was tested in E. coli and the rat, and guanylic and cytidylic acids in L. leichmannii. (C.R.)

116

Los Alamos Scientific Lab.

THE SYNTHESIS OF DEUTERO-POLYTHENE, by A. R. Ronzio. Oct. 1952. 36p. (LA-1478)

The small-scale preparation of deuteriopolythene, starting from deuterium oxide and calcium carbide, was investigated. The procedure adopted gives about 60% yields of deuteriopolythene having a melting point of 120 to 130°C and a density of 1.02 to 1.05. The ethylene-d_4 gave appreciably greater yields and polymerized at lower temperatures than ethylene-H_4. (auth)

117

Radiation Lab., Univ. of Calif., Berkeley

STUDIES IN PHOTOSYNTHESIS WITH ISOTOPES, by M. Calvin and J. A. Bassham. July 8, 1952. 39p. (UCRL-1861)

An investigation using isotopic O, H, C, and P was made of the role of these elements in the various steps in the photosynthetic reaction. A method for the identification of photosynthetic products is described which employs radioautography, and comparison of the chromatographic position of the compound with predetermined positions for known compounds in a given solvent system. After the compound is eluted from the paper it is treated chemically and the resulting material chromatographed a second time to determine whether or not the supposed chemical transformation has taken place in the radioactive compound. For final identification, the unknown radioactive material is chromatographed together with an authentic sample of the suspected substance and complete coincidence of the radioactivity, as defined on the spot on x-ray film, with the known material, as defined by some colored or otherwise visible product, is observed. The method is discussed in detail and photographs of radiograms and co-chromatograms are included. Schematic diagrams of photosynthesis, the path of C from CO_2 to hexose during photosynthesis, a proposed C cycle for regeneration of two-carbon CO_2 acceptor, and data on the role of O, H, C, and P in photosynthesis are presented. (C.R.)

118

SYNTHESIS OF L-ASCORBIC-1-C^{14} ACID FROM D-SORBITOL. Lothar L. Salomon, J. J. Burns, and C. G. King. J. Am. Chem. Soc. 74, 5161-2(1952) Oct. 20.

L-Ascorbic-1-C^{14} acid has been prepared from D-sorbitol via L-xylose, L-xylosone and the cyanohydrin reaction, giving a 70% yield based upon cyanide-C^{14}. (auth)

119

THE SYNTHESIS OF C^{14}-LABELED "SQUALENE." William G. Dauben and H. Leon Bradlow. J. Am. Chem. Soc. 74, 5204-6(1952) Oct. 20.

Concern in the metabolic fate of polyisoprenoid compounds has revived interest in the possibility of a direct conversion of the triterpene squalene to cholesterol. A convenient way to test this suggestion would be to employ squalene uniquely labeled with C^{14} in such a way that if a conversion of this type occurred, the labeled atom could singly and easily be removed from the sterol. The placement of the C^{14} at carbon atom four in cholesterol would meet this requirement, and such a labeled "squalene" has been prepared. The term "squalene" is used to indicate that the product, although a triterpene with six double bonds, is not identical with the naturally occurring compound but is a mixture of double bond isomers. The method of synthesis was that of Schmitt (Ann. 547, 115(1941)), in which a Barbier reaction between geranylacetone (dihydropseudoionone) and tetramethylene bromide is carried out in the presence of Mg. (G.Y.)

120

SYNTHESIS OF HEXESTROL LABELED WITH TWO TRITIUM ATOMS. Antoine Lacassagne, N. P. Buu-Hoï, Ng. Dat Xuong, François Zajdela, and Bernard Eckert. Compt. rend. 235, 589-90(1952) Sept. 22. (In French)

Tritiated water containing one molecule of T_2U per 4×10^6 molecules of H_2O was converted, by the action of thionyl chloride, to HCl, which was taken up by the double bond of anethole. Action of Fe powder in aqueous suspension at 90° gave hexestrol dimethyl ether, which was demethylated with boiling pyridine HCl. The resulting hexestrol (p,p'-(1,2-diethylethylene)diphenol), tritiated in the α positions of the ethyl radicals, was obtained in 10% over-all yield with a specific activity of 66 μc/g. (G.Y.)

121

SYNTHESES OF BENZENE, TOLUENE AND BENZOIC ACID LABELED IN THE RING WITH ISOTOPIC CARBON. Melvin Fields, Morris A. Leaffer, Seymour Rothchild, and John Rohan. J. Am. Chem. Soc. 74, 5498-9(1952) Nov. 5.

A satisfactory synthesis is described for preparation of ring-labeled toluene, benzoic acid, and benzene from isotopically-labeled Ba carbonate. (auth)

TRACER APPLICATIONS

122

ISOTOPE EFFECT IN SOME REACTIONS OF CARBON-14-LABELED CARBONATOTETRAMMINE COBALTIC COMPLEX ION. D. R. Stranks and G. M. Harris. J. Phys. Chem. 56, 906-10(1952) Oct.

The exchange equilibrium in aqueous solution between carbonatotetrammine cobaltic complex ion and free carbonate ion has been investigated by means of radiocarbon tracer. The equilibrium constant of the reaction, defined as the ratio of equilibrium specific activity of complexed to that of total free carbonate, was 0.875 ± 0.002 at 0°, increasing to 0.900 ± 0.004 at 30°. The apparent heat of reaction was −140 ± 25 cal/mole. The unidirectional acidic decomposition of aqueous solution of labeled carbonato complex, studied by a process of fractional examination of product specific activity, exhibited no significant isotope effect. The results of both the equilibrium and decomposition reaction investigations are satisfactorily interpreted by a qualitative application of statistical mechanical theory. (auth)

TRITIUM AND TRITIUM COMPOUNDS

123

FIXATION OF MOLECULAR TRITIUM BY BACTERIAL SUSPENSIONS. Grant N. Smith and Richard O. Marshall. Arch. Biochem. and Biophys. 39, 395-405(1952) Aug.

Tritium can be oxidized to water, apparently, through the activity of the enzyme hydrogenase. Oxidation of tritium can be carried out at very low partial pressures, e.g. 0.002 ml/l air. It has been possible to demonstrate this because of the extremely sensitive method provided by tritium. The fact that S. faccalis, not known to contain hydrogenase, was demonstrated to "fix" tritium suggests the possibility that the method may be useful for detecting low concentrations of hydrogenase. (auth)

URANIUM AND URANIUM COMPOUNDS

124

Oak Ridge National Lab.

MASS SPECTROMETER INVESTIGATION OF UF_3, by L. O. Gilpatrick, Russell Baldock, and J. R. Sites. Aug. 29, 1952. 15p. (ORNL-1376)

It was found from thermal dissociation studies that UF_3 dissociates at all temperatures from 700°C upward. The

rate of dissociation increases steadily with rising temperature to yield UF_4 and uranium metal. No evidence of the sublimation of unaltered UF_3 could be found with temperature in the range of 750 to 1000°C. (auth)

ENGINEERING

125

Knolls Atomic Power Lab.

THE EXPERIMENTAL DETERMINATION OF PIPE REACTIONS, by W. E. Cooper. Aug. 4, 1952. 27p. (KAPL-801)

In the design of power plant equipment the loads which act on the piping must be known accurately if the pipe and its adjoining structure are to be accurately stress-analyzed. This report outlines a technique whereby piping reactions may be determined during normal or simulated operation in order to check the theoretical analysis and to facilitate design revisions. (auth)

HEAT TRANSFER AND FLUID FLOW

126

California Univ., Los Angeles

DENSITY TRANSIENTS IN BOILING LIQUID SYSTEMS; INTERIM REPORT. July 1952. 131p. (AECU-2169; Report 52.17)

A program has been undertaken to study the density response of a liquid-vapor system when subjected to a change in the magnitude of a distributed heat source. The density transients are caused by the initiation, growth, and collapse of the vapor bubbles and by their travel into or out of the specified volume. A description of the apparatus used to create and record (by means of an x-ray densitometer and motion pictures) density transients at pressures from atmospheric to 1000 psia is given, and preliminary results on acidic and alkaline solutions are presented. Time lags, from the initiation of a heating pulse to the start of a density transient, of the order of 0.25 sec were most commonly observed in solutions of KOH at atmospheric pressure. In an attempt to correlate liquid superheat with system-density response, a static superheat apparatus and procedure have been developed, and a variety of superheat data obtained on H_2O and KOH solutions in glass and stainless steel is presented. The analytical phase of the program is directed toward deriving equations to describe bubble initiation and growth. Equations from Döring's theory have been applied to water at elevated pressures, and the resultant calculated superheats are compared with the experimental measurements. In order to eliminate some of the approximations in the analytical work, a molecular approach has been used to evaluate the effects of surface tension on liquid superheat. (G.Y.)

127

Oak Ridge National Lab.

FACTORS THAT INFLUENCE HEAT TRANSFER IN BOILING, by R. F. Larson. Aug. 15, 1952. 56p. (CF-52-8-178)

The attack upon the problem of how heat is transferred from a heated surface upon which a liquid is boiling has followed conventional and traditional lines set up by fluid-film and convective-flow theory. The use of the usual parameters has been only partially successful in correlation and prediction of boiling coefficients. A better understanding and a recognition of the mechanism involved is needed. This article drawn from numerous sources and observations is an attempt to describe the mechanism and to indicate the direction in which effort should be expended. (auth)

128

Massachusetts Inst. of Tech. Div. of Industrial Cooperation

TECHNICAL REPORT NO. 4 [ON] LOCAL BOILING HEAT TRANSFER TO WATER AT LOW REYNOLDS NUMBERS AND HIGH PRESSURES, by J. A. Clark and W. M. Rohsenow. July 1, 1952. 59p. (NP-4172; DIC-6627)

Local surface coefficients of heat transfer and maximum heat-flux density are presented for degassed, distilled water flowing upwards in a vertical Ni tube at mass velocities in the range 2.6 to 73 lbs/sec/ft^2 (or inlet velocities in the range 0.05 to 1.4 ft/sec), absolute pressures to 2000 psia, and liquid subcooling from 0 to 300°F. Natural convection significantly affected the nonboiling heat-transfer process; the transition from laminar to turbulent flow at the surface occurred at a length Reynolds number (viscosity based on wall temperature) between 60,000 and 100,000. Data in the region of surface boiling are emphasized. The transition was excited by the effects of superimposed free convection which increased the heat-transfer coefficient as much as 600%. The wall temperature was essentially constant for local-boiling heat transfer at lower velocities as a result of vigorous bubble agitation at the heat surface. Maximum (burnout) heat flux under conditions of local boiling with net vapor generation occurred at a bulk quality of approximately 0.80, for a boiling L/D of 52, and was independent of pressure, velocity, and initial subcooling. (TID-LC)

129

HEAT TRANSFER IN LAMINARY FLOW BETWEEN PARALLEL PLATES. J. A. W. van der Does de Bye and J. Schenk. Applied Sci. Research (Netherlands) A3, 308-16 (1952).

The heat transfer from a liquid in Poiseuille flow between parallel flat boundary walls to its surroundings has been calculated previously for walls of infinite heat conductivity. In the present article the heat transmissivity k of the wall is comparable with that of the liquid, λ/D. For two values of their dimensionless ratio, $Nu' = kD/\lambda$, equal to 2 and 20, the temperature distribution and the heat transfer are calculated. The graphs obtained allow interpolation over the whole region from $Nu' = 0$ to ∞. The results will apply to practical ducts with very flat cross section. The mathematical method may be extended to the corresponding, slightly different eigenproblem for the case of a duct with circular cross section. (auth)

130

PECULIARITIES OF REPAIRING HIGH-PRESSURE BOILERS. V. S. Bogoslovskiĭ. Rabochiĭ Energet. 2, No. 1, 4-12(1952) Jan. (In Russian)

Special requirements, such as expansion of pipe ends and their preparation for welding, repair of hatch seals and flanged joints, restoration of sealing-in valves in case of corrosion pits on disks and seats, etc., in technology and organization of high-pressure boiler repair are discussed. Fixtures used in repair operations, including a device for grinding in valve seats, are described. (G.Y.)

131

INVESTIGATION OF THERMOELEMENTS AS TEMPERATURE METERS IN A GAS FLOW AT HIGH VELOCITY. A. F. Gandel'sman, N. V. Ilyukhin, and L. N. Naurits. Zhur. Tekh. Fiz. 22, 268-76(1952) Feb. (In Russian)

The complex processes of interaction of gas flow with a solid body occurring when thermoelements are used to measure temperatures of gas flowing at high speed are analyzed. (G.Y.)

132

A STUDY OF LAMINAR SWIRLING PIPE FLOW. Lawrence Talbot. Ph.D. Thesis, Univ. of Michigan, 1952.

The problem of the decay of rotationally-symmetric steady swirl superimposed on Poiseuille flow in a round pipe

was investigated theoretically and experimentally. The object was to determine the degree to which the rate of decay of the swirl as predicted by a linearized theory agreed with measured rates of decay at flow conditions near the critical conditions for swirl instability. Swirling flow was produced experimentally by rotating a section of the test pipe. Swirl velocities were determined from motion-picture studies of colored oil droplets introduced in the flow. The stability of the swirl was investigated through visualization of a dye filament. A critical curve for swirl instability was experimentally determined relating the angular velocity of the rotating section to the Reynolds' number. Two types of instability were observed. In the low Reynolds' number range the flow remained laminar after swirl breakup. For high Reynolds' numbers instability resulted in turbulent flow. (G.Y.)

PUMPS

133

Knolls Atomic Power Lab.

DESCRIPTION AND TEST RESULTS OF A 400-GPM LIQUID METAL INDUCTION PUMP, by J. F. Cage, Jr. and E. H. Schoch. Oct. 23, 1951. Decl. Nov. 6, 1952. 93p. (AECD-3459; KAPL-619)

This report is a description of a round, 400-gpm, a-c electromagnetic pump which was manufactured and tested to determine the feasibility of its mechanical design and the accuracy of the theoretical analysis. The objective was to provide a pump, without bearings, packing, shaft seals, or moving parts of any kind, which would be capable of pumping 750°F sodium at flows up to 400 gpm against a head of approximately 40 psi for extended periods of time without leakage or other cause for maintenance. (auth)

134

Knolls Atomic Power Lab.

TEST OF 1200-GPM LINEAR A-C ELECTROMAGNETIC PUMP, by John Barnard and G. D. Collins. May 23, 1951. Decl. Nov. 6, 1952. 65p. (AECD-3460; KAPL-568)

Design and performance data are given for a straight-line, a-c induction electromagnetic pump to be used for pumping 1250-gpm of liquid Na at a pressure of 38 psi at temperatures up to 750°F are described. (J.E.D.)

135

Knolls Atomic Power Lab.

ELECTROMAGNETIC PUMPS FOR HIGH TEMPERATURE LIQUID METAL, by J. F. Cage, Jr. [nd] 31p. (AECU-2282)

A summary report is presented describing electromagnetic pumps for liquid metals. The pumps vary in size and application from small-scale laboratory pumps to those suitable for circulating liquid metal in a nuclear reactor power plant. The design and performance characteristics of the a-c and d-c Faraday types, helical-flow induction type, and the linear induction pump are described. (J.E.D.)

MINERALOGY, METALLURGY, AND CERAMICS

CERAMICS AND REFRACTORIES

136

Atomic Energy Research Establishment, Harwell, Berks (England)

PRACTICAL AND THEORETICAL ASPECTS OF THE HOT PRESSING OF REFRACTORY OXIDES, by P. Murray, E. P. Rodgers, and A. E. Williams. July 30, 1952. 37p. (AERE M/R-893)

The hot pressing characteristics of the oxides of Al, Be, Ca, Mg, Th, U, and Zr are described and the sintering rates and final bulk densities obtained are related to the applied pressure and the conditions of initial preparation of the powders. The process is also discussed from a theoretical standpoint; equations have been derived from the Mackenzie-Shuttleworth mechanism relating the end-point density with applied pressure, surface tension, yield stress, and the number of closed pores per unit volume. The predictions of these equations in relation to the effect of pressure on sintering rates and the final bulk densities are in accord with practice. (auth)

137

National Bureau of Standards

INTERIM REPORT ON EVALUATION OF TESTS FOR CERMETS AS COMPONENTS OF HEAT-RESISTANT MATERIALS, by G. B. Massengale, L. E. Mong, M. B. Stiefel, and R. A. Heindl. Apr. 25, 1952. 124p. (NBS-1624)

Unclassified references to cermets, refractory materials, equipment, and methods of testing have been gathered as a source of information for evaluating methods of testing which may lead to the use of suitable cermets for ordnance applications. References to 348 unclassified reports either dealing with or pertinent to cermets have been abstracted, listed, or summarized, and have been indexed by research organization, subject, and material. (auth)

138

New Jersey Ceramic Research Station, Rutgers Univ.

HIGH THERMAL SHOCK CERAMICS; PART II OF QUARTERLY PROGRESS REPORT NO. 1 [FOR] DECEMBER, 1950–MARCH 1, 1951, TIP U18054. 1951. 18p. (U-18056)

139

New Jersey Ceramic Research Station, Rutgers Univ.

DEVELOPMENT OF CERAMIC BODIES WITH HIGH THERMAL CONDUCTIVITY; PART I OF QUARTERLY PROGRESS REPORT NO. 2, TIP U18991. [1951] 23p. (U-18992)

140

PROPERTIES OF SOME HIGH TITANIA DIELECTRIC CERAMICS. Ernest G. Graf. Am. Ceram. Soc. Bull. 31,, 279-82(1952) Aug.

The properties of the more common titanates and the steps necessary to fabricate dielectric bodies are briefly discussed. Various methods of altering the dielectric properties over the normal temperature range by means of additions which affect the crystal structure are illustrated for capacitors consisting mainly of Ba titanate. The effects of some commonly encountered contaminants are also illustrated. (auth)

CORROSION

141

PASSIVITY OF TITANIUM IN HYDROCHLORIC ACID SOLUTIONS. David Schlain and Joseph S. Smatko. J. Electrochem. Soc. 99, 417-22(1952) Oct.

Electrode potential measurements and weight loss corrosion tests indicate that air or low concentrations of certain dissolved metals passivate titanium in hydrochloric acid solutions and that passivity is accompanied by more noble electrode potentials. Air passivates titanium in acid up to 3N. Two hundred mg/l Cu^{++} is effective in 10N hydrochloric acid and 2 mg Cu^{++} passivate titanium in 5N acid. The more noble electrode potentials indicate that a reaction involving oxygen, metal ions, or ions containing oxygen takes place at the passive surface but there is no visible deposit on, or change in, the appearance of the surface except for an occasional slight tarnish. Titanium in contact with small volumes of stagnant 10N hydrochloric acid containing 200 mg/l Cu^{++} loses its passivity after a period of time. This time interval seems to be directly proportional to the ratio of

solution volume to specimen area and the loss of passivity is attributed to the presence of atomic hydrogen. (auth)

GEOLOGY AND MINERALOGY

142

Geological Survey

PITCHBLENDE DEPOSITS AT THE WOOD AND CALHOUN MINES, CENTRAL CITY MINING DISTRICT, GILPIN COUNTY, COLORADO, by F. B. Moore and C. R. Butler. 1952. 8p., 3 illus. (GS-C-186)

Pitchblende has been mined in commercial quantities from four gold- and silver-bearing pyrite-sphalerite-galena veins that occur in an area about one-half mile square on the south side of Quartz Hill, Central City district, Gilpin County, Colo. These veins are the Kirk, the German-Belcher, the Wood, and the Calhoun. Two of these veins, the Wood and the Calhoun, were studied in an attempt to determine the geologic factors favorable for pitchblende deposition. All accessible workings at the Wood and East Calhoun mines were mapped by tape and compass, and the distribution of radioactivity was studied in the field. Channel and chip samples were taken for chemical assay to compare radioactivity with uranium content. The pitchblende-bearing veins cut both pre-Cambrian granite gneiss and quartz-biotite schist; however, the gneiss was the more favorable host rock. Two bostonite porphyry dikes of Tertiary(?) age were crosscut by the Wood and Calhoun veins. The pitchblende occurs in lenses erratically distributed along the veins and in stringers extending outward from the veins. In the lenses it forms hard masses, but elsewhere it is soft and powdery. The pitchblende is contemporaneous with the pyrite but earlier than the sphalerite and galena in the same vein. All the observed pitchblende was at depths of less than 400 ft. The veins probably cannot be mined profitably for the pitchblende alone under present conditions. (auth)

143

Geological Survey

URANIUM OCCURRENCES ON MERRY WIDOW CLAIM, WHITE SIGNAL DISTRICT, GRANT COUNTY, NEW MEXICO, by Harry C. Granger and Herman L. Bauer, Jr. 1952. 16p., 2 illus. (GS-C-169)

The Merry Widow claim is near the center of sec. 22, T. 20 S., R. 15 W., New Mexico principal meridian, about 1 mile west of White Signal, Grant County, N. Mex. Secondary uranium minerals were not discovered in the White Signal district until the early 1920's, although several mines in the district had been worked previously for gold, silver, and copper. The writers mapped the Merry Widow claim in 1950, collected 133 samples, and logged the core from one diamond-drill hole on the Merry Widow claim. The pre-Cambrian granite that forms much of the country rock in the vicinity of the claim is intruded by numerous dikes that represent extremes in composition—from basalt to pegmatite. The uranium deposits generally occur in basalt or diabase near one of the many strongly oxidized quartz-pyrite veins that are common in the district. Locally, as in the Merry Widow mine, the uranium minerals torbernite and autunite are in fractured granite or latite adjacent to a quartz-pyrite vein. A diamond-drill hole located about 400 ft south of the Merry Widow shaft cut the vein at a depth of 520 to 550 ft. Even at this depth the persistent veins are completely oxidized; and although secondary uranium minerals and radioactive fracture surfaces were seen throughout the core, no primary uranium minerals were identified. At 15 localities on the claim, the surface rocks display abnormal radioactivity. Diabase is at eight localities, granite at three, latite at two, and basalt at one; in the Merry Widow mine, diabase, latite, and granite are all uranium-bearing adjacent to the Merry Widow vein. The close relation between uranium mineral distribution and the oxidized parts of quartz-pyrite veins suggests that the unoxidized parts of the veins may contain primary uranium minerals. The generally high phosphate content of the basic intrusive rocks in the district may account for the localization of phosphate-bearing uranium minerals near the intersections of quartz-pyrite veins with diabase and other subsilicic rocks. If further prospecting is done, it should be directed along these veins, especially near the intersections with diabase. (auth)

144

Geological Survey

RADIOACTIVITY OF SELECTED ROCKS AND PLACER CONCENTRATES FROM NORTHEASTERN ALASKA, by Max G. White. 1952. 12p. (GS-C-195)

Radiometric examination of 13 samples collected in the Mount Michelson area, northeastern Alaska, in 1948, shows that four samples of gneissic granite contain an average of 0.007% equivalent uranium. The heavy-mineral fractions from three of these four samples contain an average 0.052% equivalent uranium and 0.03% uranium. The heavy-mineral fractions of panned concentrates from gravels of streams draining relatively large areas of granitic rock, contain an average of 0.028% equivalent uranium, whereas similar heavy fractions of panned concentrates from streams that drain areas other than those largely underlain by granitic rock contain an average of only 0.005% equivalent uranium. Mineralogic study of all heavy-mineral fractions having more than 0.01% equivalent uranium indicates that the radioactive material apparently is confined to biotite, which in one sample contains 1.19% uranium. Fluorite, hematite, zircon, sphene, galena, and molybdenite, commonly associated elsewhere with uranium, apparently are disseminated in the granite with the biotite. The presence of uranium in the biotite of the granite and, of other minerals associated with uranium elsewhere, suggests that this area should be considered in relation to others in Alaska as a possible locality to search for high-grade uranium deposits.

Radiometric and mineralogic study of 19 placer concentrates revealed the presence of monazite on Rye Creek in the Wiseman district and on several creeks northeast of Chandalar Lake in the Chandalar district, upper Yukon region, northeastern Alaska. Uranium-bearing thorianite(?) occurs on the South Fork of the Koyukuk River at Gold Bench and vicinity in the Wiseman district. (auth)

145

Geological Survey

THE PERMIAN PHOSPHORITE DEPOSITS OF WESTERN UNITED STATES, by V. E. McKelvey, R. W. Swanson, and R. P. Sheldon. Oct. 1952. 30p. (TEI-263)

The Permian marine phosphorite deposits of the western U. S. were laid down in the Phosphoria formation and its partial stratigraphic equivalents over an area of about 135,000 square miles in Montana, Idaho, Wyoming, Utah, and Nevada. The deposits in the eastern part of the field lie on the western margin of the structurally simple North American craton. The rocks there consist of a few thin, locally glauconitic, nodular phosphorites, generally containing less than 30 percent P_2O_5, interbedded with nodular limestones, calcareous mudstones, and sandstones. Eastward these marine beds tongue out into continental redbeds. The deposits in the western part of the field are a part of the complexly folded Cordilleran miogeosyncline. The facies there are of a deeper-water type and include thick phosphorite layers containing as much as 35 percent P_2O_5, black phosphatic mudstones, limestones, and well-bedded black cherts. The phosphorite deposits are composed chiefly of colloform carbonate-fluorapatite, quartz, and clay. In addition to phos-

phorus, they contain several minor elements that are of potential economic interest. The most important of these are fluorine, vanadium, chromium, nickel, rare earths, zinc, and uranium. (auth)

146

Geological Survey

THE GEOLOGY OF THE FLORIDA LAND-PEBBLE PHOSPHATE DEPOSITS, by J. B. Cathcart, L. V. Blade, D. F. Davidson, and K. B. Ketner. Sept. 1952. 21p. (TEI-265)

The land-pebble phosphate district is on the Gulf Coastal Plain of Florida. The phosphate deposits are in the Bone Valley formation, dated Pliocene by most writers. These strata overlie the Miocene Hawthorn formation and are overlain by unconsolidated sands 3 to 20 feet thick. The minable phosphate deposits, called "matrix" in the district, range from a featheredge to about 50 feet in thickness and consist of phosphatic pellets and nodules, quartz sand, and montmorillonitic clay in about equal proportions. Locally the matrix displays cross-bedding and horizontal laminations, but elsewhere it is structureless. The phosphorite particles, composed largely of carbonate-fluorapatite, range in diameter from less than 0.1 mm to about 60 cm and in P_2O_5 content from 30 to 36%. Coarse-pebble deposits, containing 30 to 34% P_2O_5 are found mainly on basement highs; and fine-pebble deposits, containing 32 to 36% P_2O_5, are found in basement lows. Deposits in the northern part of the field contain more phosphate particles and their P_2O_5 content is higher than those in the southern part. The upper part of the phosphatic strata is leached to an advanced degree and consists of quartz sand and clay-sized particles of pseudowavellite and wavellite. The leached zone ranges in thickness from a featheredge to 60 feet. The origin of the land-pebble deposits is incompletely known. Possible modes of origin are a residuum of Miocene age, or a reworked residuum of Pliocene or Quaternary age. (auth)

METALS AND METALLURGY

147

Ames Lab.

CONSTITUTION DIAGRAM OF THE COPPER-ZIRCONIUM ALLOY SYSTEM, by Richard Norman Augustson. Dec. 20, 1950. Decl. Oct. 20, 1952. 64p. (AECD-3456; ISC-138)

The major aims of this investigation were to determine the constitution diagram of the copper-zirconium alloy system in the zirconium-rich region and to evaluate the corrosion resistance and hardness properties of the alloys prepared. The following conclusions summarize the accomplishment of these aims. In the copper-zirconium alloy system, with zirconium content above 60 wt. %, an intermetallic compound, identified as $CuZr_2$ and having a melting point of 1065°C., was located at 73.6% zirconium. The crystal structure of this compound is body-centered tetragonal, with unit cell dimensions of c = 11.3 ± 0.2 A and a = 3.3 ± 0.2 A. A eutectic between $CuZr_2$ and zirconium was located at 80.3% zirconium with a eutectic temperature of 998°C. A eutectoid was located at 95.0 ± 0.5% zirconium and 916 ± 15°C. No pyrophoric alloys were encountered in the region studied. The addition of even very small amounts of copper to zirconium was found to give an alloy harder than that of the zirconium itself and the hardness rose, in general, with increased copper concentration. Only slight improvement, if any, in the corrosion resistance was noted after the addition of small amounts of copper to the zirconium, while a higher copper concentration definitely decreased this resistance. The extent to which oxygen has altered the various transformation temperatures herein reported, or increased the hardness and reduced the corrosion resistance of the alloys, was not considered specifically in this investigation. Only the possibilities can be acknowledged at this time. (auth)

148

Carbide and Carbon Chemicals Co. (Y-12)

INVESTIGATION OF XERORADIOGRAPHY FOR RADIOGRAPHIC INSPECTION WITH 1000 KV X-RAY AND COBALT 60 SOURCES, by R. E. Cofield, H. D. Whitehead, and L. E. Burkhart. May 5, 1952. Decl. Nov. 12, 1952. 15p. (AECD-3461; Y-871)

The possibility of adapting xeroradiography, a low-cost, all-electric method of obtaining x-ray images, to the examination of U metal was investigated. The techniques adopted were used to obtain resolution and penetrameter sensitivity of 2 to 4% through thicknesses of U up to one-half inch. The resolution compared favorably with published results for conventional film radiography of radioactive heavy metals. (auth)

149

Illinois Univ.

PROGRESS REPORT NO. 1 ON ANNEALING OF COLD WORKED METALS, by Paul A. Beck and Alfonso Merlini. Oct. 1, 1952. 22p. (AECU-2281; Progress Report No. 1)

Improved integrating specimen holders were designed and built for the quantitative determination of preferred orientation by means of the reflection and the transmission methods. Specimen and slit alignment procedures were developed for use with both methods, to improve the accuracy. (111) and (200) pole figures were determined for cross-rolled copper. These show two major texture components of the type (110) [223] and of a minor texture component consisting of spreads around the cube texture. (auth)

150

Knolls Atomic Power Lab.

INTERCRYSTALLINE FRACTURE AND TWINNING OF IRON AT LOW TEMPERATURES, by John R. Low, Jr. and R. G. Feustel. nd 17p. (AECU-2283)

It has been found that small amounts of carbon may strongly influence the ductility and the mode of fracture of iron at low temperatures. Irons containing 0.03 to 0.05% carbon when tested in tension at −195°C normally exhibit considerable ductility and fracture by trans-crystalline cleavage. After decarburization in moist hydrogen the same materials are completely brittle and fracture occurs by inter-crystalline cleavage; recarburization restores the original properties and mode of fracture. Incomplete decarburization, which leaves the room temperature properties unaffected, leads to inter-crystalline fractures and brittleness at −195°C; however, the low temperature ductility and trans-crystalline mode of fracture may be restored by homogenization. The observations on twinning in decarburized and carburized irons are believed to demonstrate that twinning is a secondary phenomenon and cannot be considered as a cause of low temperature brittleness. (auth)

151

Metallurgical Labs., Dow Chemical Co.

PREPARATION OF HIGH PURITY MAGNESIUM AND A STUDY OF THE EFFECT OF NON-METALLIC AND ALKALI METAL IMPURITIES ON THE CORROSION CHARACTERISTICS OF PURE MAGNESIUM; ELEVENTH QUARTERLY REPORT COVERING PERIOD JUNE 1, 1952 – AUGUST 31, 1952. [nd] 26p. (COO-99)

Corrosion characteristics of the Mg-Fe-Al alloy system were studied to determine the iron tolerance limit in alloys containing 0.1 to 10% aluminum. A gradual increase in the corrosion rate was obtained upon going from 10 to 46 ppm Fe in the presence of aluminum or with aluminum

increasing from 0.1 to 3% accompanied by 10 to 46 ppm iron. A sharp rise in corrosion rate was observed when the aluminum content exceeded 3%. Alloys of Mg-Fe-Si, Mg-Fe-Cl, Mg-Fe-C, Mg-S, and Mg-Fe-S were tested in a chamber designed to give exposure to air at 100% relative humidity and condensed water vapor. A metallographic examination of the Mg-Si and Mg-Fe-Si alloys was undertaken to correlate the microstructures with the corrosion properties previously reported. (auth)

152

Armour Research Foundation

PHASE DIAGRAMS OF ZIRCONIUM-BASE BINARY ALLOYS; THE ZIRCONIUM-OXYGEN SYSTEM COVERING PERIOD JULY 1 – SEPTEMBER 30, 1952, by Robert F. Domagala and Donald J. McPherson. Sept. 30, 1952. 13p. (COO-100; Report No. 2)

The progress of the work on the determination of O-Zr binary phase diagram from 0 to 50 at. % is presented. The experimental techniques employed for the preparation of binary O-Zr systems ranging in composition from 0.1 to 26 wt. % O for a study of phase relationships in this system are discussed. The allotropy of $ZrCr_2$ and alternative diagram types based on an as-cast survey of alloys are reported. (J.E.D.)

153

Knolls Atomic Power Lab.

THERMAL CONDUCTIVITY, ELECTRICAL RESISTIVITY, AND THERMOELECTRIC POWER OF TITANIUM ALLOY RC-130-B, by W. W. Tyler and A. C. Wilson, Jr. Sept. 8, 1952. 41p. (KAPL-803)

Thermal conductivity, electrical resistivity, and thermoelectric power measurements have been made in the temperature range from 20 to 300°K for a commercial Al-C-Mn-Ti alloy designated as RC-130-B and manufactured by Rem-Cru Titanium, Inc. The thermal conductivity of this alloy is low, varying from about 0.004 cal/cm-sec-°K at 20°K to about 0.02 cal/cm-sec-°K at 300°K. Its electrical resistivity is about 150 microhm-cm and fairly independent of temperature. The Wiedemann-Franz ratio for this alloy is about 5 times the theoretical value at 20°K and decreases to about 2 times the theoretical value at 300°K. The absolute thermoelectric power is negative throughout the temperature range studied with a value of about 5 microvolts/°K at 300°K. Measurements of the thermal conductivity, electrical resistivity, and thermoelectric power have been made from 65 to 300°K for Type 316 stainless steel. Several data points are also reported for Type 304 stainless steel. The thermal conductivity of Type 316 is somewhat lower than that of Type 304 but about 1.6 times that of the titanium alloy in the temperature range from 100 to 300°K. (auth)

154

Naval Gun Factory

COARSENABILITY OF THE ALUMINUM-COPPER AND ALUMINUM-SILICON CASTING ALLOYS, by Harold Bernstein. July 17, 1952. 15p. (NGF-T-29-52; U-23914)

Grain-coarsening tests were carried out on small melts of Al-Cu and Al-Si alloys prepared in an electrical resistance furnace. The effects of 3 variables, pour (1300 to 1675°F) and mold temperatures (400 to 1000°F), and melt composition were determined. Rivet specimens (80 g) representing each test condition were cast in a split-graphite mold. These castings were sectioned, polished, and macroetched, and their grain sizes were measured. In general, the macrostructure coarsened with increased pour temperature. Coarsening was extreme in the unrefined alloys but was suppressed by active grain refiners. The grain structure of the unrefined Al-Cu alloy was attributed largely to the nucleating action of relatively insoluble impurities and the cooling rate in the mold. An active grain-refiner additive counteracted the coarsening, caused by superheating or a slow rate of cooling, by the formation of stable nuclei. Boron was the most effective refiner tested. (TID-LC)

155

Watertown Arsenal Lab.

NUCLEONICS APPLICATIONS; METALLURGICAL APPLICATIONS OF AUTORADIOGRAPHY. I. A LITERATURE SURVEY. II. PRELIMINARY EXPERIMENTS, by Samuel Millman and Laurence S. Foster. Jan. 2, 1952. 35p. (NP-4074; WAL-843/8)

Results of a literature survey of autoradiographic techniques as applied to metallurgy are reported. The possible application of autoradiographic techniques at high magnification (X1500) to the study of temper brittleness in steels and other problems in physical metallurgy has been proposed. Samples of SAE No. 2335 steel and of an iron–phosphorus alloy have been activated by neutron irradiation and the resulting activities are analyzed. Use of nuclear track emulsions and development of experimental procedures have been initiated. Representative photomicrographs are shown. (auth)

156

Armour Research Foundation

INTERIM TECHNICAL REPORT NO. 2 [ON] SURFACE HARDENING OF TITANIUM WITH METALLOID ELEMENTS [FOR] DECEMBER 1, 1951 TO MAY 31, 1952, by R. W. Hanzel and Verne Pulsifer. [nd] 41p. (NP-4089; WAL-401/13; Interim Technical Report No. 2)

The effects of the metalloid elements O, N, C, B, and H on the surface-hardening characteristics of commercially-pure Ti, special Ti base binary alloys, and several commercial alloys are reported herein. The solid-solution hardening effect of N appears most promising at this time. N accomplishes hardening, but in large amounts it seriously embrittles Ti. A series of special Ti base binary alloys has been prepared in an attempt to realize a dispersion hardening effect by the formation of an insoluble and stable-alloy nitride precipitate. This has not been observed metallographically and is not indicated in the hardness surveys taken to date. The majority of the alloys had little effect in increasing the over-all hardness. Several of the alloys, Ti-V and Ti-B in particular, appear to harden in the 1200 to 1400°F temperature range. The commercially-pure Ti and the other alloys show no significant hardening below 1600°F. Preliminary carburizing treatments, both gaseous and solid, have been studied and evaluated. Under the specific conditions of treatment described herein, rough, porous, loosely-adherent surface layers were formed. These surface layers cracked and spalled during preparation for metallographic study. The electrolytic treatment of commercially pure Ti in molten borax is under study. Preliminary results reveal the formation of unusual surface hardnesses. Surface hardnesses as high as 1500 (Vickers, 10 kg load) have been obtained on samples treated in this way. (auth)

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Horizons, Inc.

TECHNICAL PROGRESS REPORT [FOR] FIRST QUARTER, MAY 1 TO JULY 31, 1952 [ON] INVESTIGATIONS FOR THE PRODUCTION OF THORIUM METAL BY FUSED SALT ELECTROLYSIS, by Merle E. Sibert and Morris A. Steinberg. July 31, 1952. 55p. (NYO-3725)

Investigation of the production of Th metal by fused-salt electrolysis has been initiated. Equipment capable of producing at least 1 lb of Th metal per day has been designed, built, and installed and is at present in full operation. Initial experimental results on Th production obtained by electrolysis of $KThF_5$ in an electrolyte of NaCl at a temperature of

750 to 800°C indicate that a high-purity, ductile Th metal can be rather easily produced at a fairly good efficiency. Melted samples of this electrolytic Th, after arc-melting into small ingots, are extremely soft, with an average hardness of Rockwell B 10-20 being readily obtained. In addition, these ingots can be cold-rolled to 99% reduction in the cast condition, to foil 0.002 in. in thickness, and into wire 0.030 in. in diameter with no difficulties being encountered. A literature survey on preparation, physical properties, and chemical properties of Th and its compounds is appended. (G.Y.)

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General Electric Research Lab.

TWELFTH QUARTERLY REPORT (PROGRESS REPORT NUMBER 13) [ON] DEVELOPMENT OF ZIRCONIUM BASE ALLOYS, by J. H. Keeler, W. R. Hibbard, Jr., and B. F. Decker. Oct. 5, 1952. 11p. (SO-2507; Progress Report No. 13)

Textures of cold-rolled and annealed crystal-bar zirconium and of hot-rolled zirconium were determined and are summarized with the deformation and annealing textures previously discussed in project reports. (auth)

159

THE OPTICAL PROPERTIES OF LIQUID SELENIUM. E. W. Saker. Proc. Phys. Soc. (London) B65, 785-7(1952) Oct. 1.

The optical properties of liquid Se in the near infrared have been measured for a temperature range up to about 400°C. The absorption edge moves out to longer wavelengths as the temperature increases by an amount corresponding to a change of energy gap of 1.4×10^{-3} ev/C°. Absorption is very small at low frequencies. For long wavelengths the refractive index decreases as the temperature increases by an amount corresponding to the thermal expansion. (auth)

160

SPOT WELDING OF TITANIUM ALLOY SHEET. M. L. Begeman, E. H. Block, Jr., and Frank W. McBee, Jr. Welding J. (N.Y.) 31, 469S-474S(1952) Oct.

A study of the welding characteristics of a commercial Ti alloy, TI-100A, with particular regard to weld strength, penetration, indentation, hardness, and microstructure, indicates that this alloy can be effectively fabricated by the spot-welding technique. The welding range is wide, and close control of any major variables affecting the weld appeared to be unnecessary unless certain weld characteristics were desired. Weld penetration appears to be higher and more difficult to control than in most other metals. Limited tip-shape investigations as well as the tip-force tests made indicate that with further investgiation these variables may be more effectively used to control weld penetration and strength. (G.Y.)

161

WELD CRACKING OF ALUMINUM ALLOYS. J. D. Dowd. Welding J. (N.Y.) 31, 448S-456S(1952) Oct.

A simple test capable of quantitatively evaluating the crack sensitivity of welds made in Al alloys has been developed. In this test the amount of longitudinal cracking in the fillets of an inverted T-joint specimen is used as a measure of the crack sensitivity. The effects of specimen dimensions, preheat temperature, post heating, welding current, and welding technique on the cracking obtained in the test specimen have been evaluated, and standard procedures for making the test have been established. Using these procedures, the crack sensitivities of the non-heat-treatable Al-Mg alloys, 4S-O, 52S-O, XA54S-O and X56S-O; the heat-treatable Al-Mg silicide alloys, 53S-T6, 61S-T6 and 62S-T6; and the high-strength heat-treatable alloys, Alclad 14S-T6, Alclad 24S-T4, and Alclad 75S-T6, welded with various filler alloys were evaluated. It was found that for any of the plate compositions, welds made with 43S or No. 716 brazing wire gave the least amount of cracking but generally had lower ductility than welds made with Al-Mg alloy filler wires. The amount of cracking obtained in welds made with Al-Mg alloy filler wires was found to decrease as the Mg content of the filler wire increased. (auth)

162

FLASH WELDING OF TITANIUM ALLOYS. I. A. Oehler. Welding J. (N. Y.) 31, 950-1(1952) Oct.

Tests on commercial Ti alloys RC70, RC-130B, and TI-150A indicated that flash butt welding can be readily accomplished if the material is of good quality and uniform structure; techniques similar to those used for Al are employed, and welded parts are annealed or otherwise furnace treated immediately after welding. Sensitivity of the alloys to cracking in areas such as Brinell impressions or ground-off surface defects are avoided by the annealing. Ti alloys were flash welded to Al alloys and carbon steel; failure occurred outside the weld when tested in tension or bending. (G.Y.)

163

SMALL ADDITIONS RAISE STRENGTH OF ZIRCONIUM AT ELEVATED TEMPERATURES. A. D. Schwope and W. Chubb. J. Metals (N. Y.) 4, 1138-40(1952) Nov.

The effects of small amounts of a number of elements upon the strength of Zr have been studied. The results agree in general with the data available in the literature, and show the effects of small additions upon the high-temperature strength of induction-melted Zr. It is apparent that Mo and possibly Nb are most effective in strengthening Zr at temperatures below 500°C, but that Al, Ta, and V are most effective in maintaining the strength of Zr at temperatures above 600°C. Ti seems to be most effective in the range 300 to 700°C. (auth)

164

TITANIUM CASTING RESEARCH TESTS SHELL MOLDED REFRACTORIES. J. G. Kura. Iron Age 170, No. 18, 88-92(1952) Oct. 30.

Ti's consuming appetite for ordinary refractories has forced the industry to investigate new mold materials for Ti castings. The most promising are shell-molded mixtures of stabilized zirconia and fused zirconia containing 4% resin, used without mold washes. The best mold wash for silica appears to be a colloidal graphite dispersion. Good surface and soundness of cast Ti containing only small amounts of surface contamination have been obtained. (G.Y.)

165

MAGNESIUM-RICH SIDE OF THE MAGNESIUM-ZIRCONIUM CONSTITUTION DIAGRAM. J. H. Schaum and H. C. Burnett. J. Research Natl. Bur. Standards 49, 155-62(1952) Sept.

The Mg-rich side of the Mg-Zr constitution diagram has been studied for the purpose of improving the previous work on this subject. A diagram has been developed that is similar in form to that found by previous investigators, but the phase boundaries differ as to temperatures and alloy compositions. The peritectic reaction was found to take place at 654°C beginning at 0.58% Zr. (auth)

166

THERMODYNAMIC PROPERTIES OF THE LIQUID TERNARY SYSTEM BISMUTH–CADMIUM–TIN. Svante Mellgren. J. Am. Chem. Soc. 74, 5037-40(1952) Oct. 20.

The activity of Cd in liquid Bi–Cd–Sn alloys has been determined with the aid of emf measurements. From these values the integral molar excess free energy and the partial molar excess free energies of all components have been calculated. (auth)

167

MECHANICAL PROPERTIES OF CAST ALUMINUM ALLOYS. N. M. Beskorovaĭnĭi and Ya. B. Fridman. Liteĭnoe

Proizvod., No. 1, 15-20(1952) Jan. (In Russian)

The mechanical properties of Al-base alloys with 9.0 to 10.6% Si under loading for tension, compression, torsion, and bending have been studied. The effect of dimensions and shape of specimens and mode of loading on the mechanical properties of cast alloys have been investigated, and the effect on grain size of modification with metallic Na is discussed. (G.Y.)

168

THE HEAT OF FUSION OF LITHIUM. Scott B. Kilner. J. Am. Chem. Soc. 74, 5221-2(1952) Oct. 20.

The heat of fusion of Li was determined calorimetrically to be 0.69 ± 0.07 kcal/gram atom. The melting point was found to be 179 ± 1°C. (G.Y.)

169

PERMEABILITY OF STEEL TO LITHIUM. Albert Hérold, Pierre Muller, and Pierre Albrecht. Compt. rend. 235, 658-9(1952) Sept. 29. (In French)

Commercial soft steel (0.1% C) tubes containing Li were heated at various temperatures up to 1100°C. Permeability was observed even at temperatures below 700°C by spectrographic analysis of the exterior of the tube. Tubes previously annealed in H_2 at 900°C for a number of hours showed no permeability even at 1100°C, although the same tubes subsequently heated at 600°C in the presence of graphite permitted massive passage of Li. It is concluded that Li traverses steel through fissures formed by dissolution of C. However, steel quenched from 1100°C in cold Hg in order to retain the solid solution of C in γ Fe did not exhibit permeability even at 900°C, fissure formation probably being rendered difficult by the presence of resistant masses of crystallized cementite. (G.Y.)

170

AUTORADIOGRAPHIC TECHNIQUE USING NEUTRON IRRADIATION TO IDENTIFY THE BORON CONSTITUENT IN BORON STEEL. Henriette Faraggi, André Kohn, and Jean Doumerc. Compt. rend. 235, 714-16(1952) Oct. 6. (In French)

Autoradiographic representation of the B precipitations in steel containing as little as 0.010% B was found to be possible following exposure of steel samples to a total of 5×10^{11} to 10^{13} neutrons/cm^2. Several autoradiographs are compared with micrographs of the same areas. (G.Y.)

PHYSICS

171

Los Alamos Scientific Lab.

MIXING OF FRICTIONLESS, INCOMPRESSIBLE SUBSTANCES, I, by John W. Calkin. Sept. 30, 1952. 40p. (LA-1472)

The familiar system of equations for the mixing of two frictionless incompressible substances in one dimension is discussed. While it is known that external forces are necessary to initiate such mixing, the equations themselves admit solutions in the absence of such forces. By means of a contact transformation on the variables involved, the general solution of the system under this assumption is determined, and a large subclass discussed in considerable detail. All of these are found to be stable in the sense that the width of the zone in which appreciable mixing occurs tends to zero as time increases. For some such solutions, however, the surface between the two materials actually reestablishes itself, with a portion of one material being detached from its parent substance and sifting into the other. These, therefore, must be regarded as unstable for reasons which lie outside the one-dimensional theory. (auth)

172

Massachusetts Inst. of Tech.

STUDY OF METAL-CERAMIC INTERACTIONS AT ELEVATED TEMPERATURES, by F. H. Norton, W. D. Kingery, et al. Oct. 1, 1952. 14p. (NYO-3141)

During the present period, additional surface tension measurements have been attempted with liquid copper by the sessile drop method and with liquid Al_2O_3 by the pendant drop method. Preliminary results are discussed. By means of equilibrium interfacial angle measurements, estimates of the surface tension of solid Al_2O_3 and ZrO_2 (Ni-stabilized) and interfacial tensions with Ni have been estimated at 1850°C. The interfacial and surface adsorption of silicon from iron-silicon alloys on Al_2O_3 has been studied. The sintering of glass spheres has been found to occur by viscous flow. Measurements of the sintering of Al_2O_3, and ZrO_2 are inconclusive due to insufficient microscopic resolution and time measurements during the initial stages of the process. (auth)

173

Radiation Lab., Univ. of Calif., Berkeley

RESONANT CAVITY FIELD MEASUREMENTS, by S. W. Kitchen and A. D. Schelberg. Sept. 11, 1952. 24p. (UCRL-1947)

The application of perturbation techniques to the quantitative measurement of both relative electric and relative magnetic fields in resonant cavities is described. The apparatus, procedures, advantages, and limitations are discussed, and the experimental results are compared with the calculable field distributions of a coaxial resonator. The theoretical shunt impedance and Q obtained empirically agree, respectively, within one and four percent of the calculated values. (auth)

174

Radiation Lab., Univ. of Calif., Berkeley

PHYSICS DIVISION QUARTERLY REPORT [FOR] MAY, JUNE, AND JULY 1952. Sept. 16, 1952. 21p. (UCRL-1948)

Progress is briefly reported on the following projects: photoproduction of π^0 mesons from C, Al, Cu, and Pb targets; polarization effects in nucleon-nucleon scattering; 60-in. cyclotron operation and development; and synchrotron operation. (L.T.W.)

175

RING SHIMS FOR CONED MAGNET POLECAPS. E. R. Andrew and F. A. Rushworth. Proc. Phys. Soc. (London) B65, 801-5(1952) Oct. 1.

The calculation of ring shims of the kind suggested by Rose (Phys. Rev. 53, 715(1938)) has been extended to include polecaps in the form of truncated cones. Design data are presented in graphical form. Actual and predicted performances are compared for one magnet. (auth)

176

HEATS OF SOLUTION OF GROUP IB METALS IN LIQUID TIN. L. B. Ticknor and M. B. Beaver. J. Metals 4, 941-5 (1952) Sept.

An isothermal calorimeter suitable for measurements of heats of solution in liquid tin as solvent is described. Measurements of the heats of solution of gold, silver, copper, and a gold-silver alloy are reported. The heat of formation of this gold-silver alloy is also reported. (auth)

177

THE THERMAL CONDUCTIVITY OF SOLID HELIUM. F. J. Webb, K. R. Wilkinson, and J. Wilks. Proc. Roy. Soc. (London) A214, 546-63(1952) Oct. 9.

The thermal conductivities of crystals of solid He at densities between 0.194 and 0.218 g/cm^3 have been measured at liquid-He temperatures. In order to interpret the results, the specific heat of solid He at these densities has

been measured from 0.6 to 1.4°K. The range of densities employed is sufficient to allow the observation of Debye characteristic temperatures varying by 40%, and of thermal conductivities varying by factors of over 10. It is shown that the conductivity measurements are in accord with the "umklapp" type of thermal resistance derived by Peierls (1929, 1935). Further work was restricted by the difficulty of obtaining good single crystals in narrow tubes, but measurements of the conductivity at one density were obtained down to 0.3°K. In this region the conductivity is limited by boundary scattering and is higher than that observed by other authors for liquid He II at similar temperatures. (auth)

178

APPLICATION OF RECOIL FROM NUCLEAR PROCESSES. Lise Meitner. Z. Physik 133, 140-52(1952). (In German)

A general discussion is presented of the historical experimental investigations in diverse fields that have been made possible by ion recoil from nuclear processes. 16 references. (G.Y.)

AEROSOLS

179

Columbia Univ.

FILTRATION OF MONODISPERSE ELECTRICALLY CHARGED AEROSOLS: PART I. FILTRATION OF CHARGED AND UNCHARGED AEROSOL PARTICLES. PART II. THE EFFECT OF DROPLET CURVATURE ON THE GROWTH AND SIZE DISTRIBUTION OF AEROSOLS. PART III. EFFECT OF CHARGING ON LIQUID DROPLET RADII. June 30, 1952. 100p. (NYO-514)

The effect of the presence of electric charges on the filtration characteristics of aerosols through various filter media was investigated. The net effect of electrical charges is to reduce the penetration uniformly as a function of radius. It is shown that some of the generally accepted results indicating the dependence of size distribution on growth occur for only special types of growth. The effect the charging of aerosol droplets has on their size is compared with the predicted effects of charged nuclei on the condensation of vapor. (L.T.W.)

ASTROPHYSICS

180

HELIUM 3 CONTENT AND AGE OF METEORITES. F. A. Paneth, P. Reasbeck, and K. I. Mayne. Geochim. et Cosmochim. Acta 2, 300-3(1952). (In English)

It has been found that the He liberated from five iron meteorites contained substantial amounts of He^3; the He^3 to He^4 ratio varied from 17.8 to 31.5%. Knowledge of the isotopic composition of the He makes it possible to estimate the contribution of cosmic rays to the He production in iron meteorites and thus to put the He method of age determination on a safer basis. (auth)

181

THE ABUNDANCES OF THE ELEMENTS. Harold C. Urey. Phys. Rev. 88, 248-52(1952) Oct. 15.

The cosmic abundances of the elements were estimated by Goldschmidt (1937) from a study of terrestrial and meteoritic abundances and a comparison of these with Russell's data on the sun. More recently Brown (Revs. Modern Phys. 21, 625(1949)) has prepared a table weighting the proportions of the iron and silicate phases according to an estimated proportion of these phases in the earth. The writer has recently proposed that the chondritic meteorites themselves may represent an average sample, and has shown that this assumption is consistent with the density of the moon, which on the basis of his recent discussion in regard to the origin of the solar system should also be approximately a sample of nonvolatile materials. A table of abundances is prepared assuming that these meteorites do represent such a mean sample. This table does not differ markedly from Goldschmidt's, but is distinctly different from Brown's, both because of a different weighting of the phases in meteorites and because of a different choice of data from the literature. Iron is much less abundant than estimated by Brown and somewhat less abundant than Goldschmidt's estimate. There is some indication for markedly low abundances of selenium and tellurium and bromine and iodine, which may indicate some escape of these elements during the formation of the meteorites. Mercury is low, almost certainly because of its loss as a volatile substance during the formation of the meteorites. (auth)

COSMIC RADIATION

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Denver Univ.

QUARTERLY PROGRESS REPORT [ON] CORRELATION OF METEOROLOGICAL PARAMETERS WITH COSMIC RAY DATA [FOR PERIOD] JANUARY 1–MARCH 31, 1951, by Mario Iona, Jr. Mar. 31, 1951. 25p. (U-18954; Report No. 8)

One set of circuits were completed for measuring meson intensity. The number of counts recorded during the summer in hourly intervals and the lengths of the intervals were transcribed from the film record and the counting rates evaluated for hourly intervals. No correlation with magnetic disturbances was detected. Certain regularities in the records suggested a common origin of disturbances of the cosmic-ray intensities, but the data were inconclusive. Diurnal variations appeared to be superimposed on slow changes during certain intervals, but the phenomenon could not be found throughout the period of operation and occurred at different hours of the day for the different components. Many of the slow variations of the intensity were attributed to pressure changes. Statistical fluctuations made difficult the establishment of exact time correlations between the meson intensities and barometric changes, but a possible time lag was indicated. (cf. TIP U17117) (TID-LC)

183

MOMENTS OF LATERAL SCATTERING IN SHOWERS. L. W. Nordheim. Z. Physik 133, 94-100(1952). (In German)

A recursion equation is derived for the moments of all orders of the lateral and angular variations of cascade showers. In principle, this makes possible the calculation of moments with the help of the longitudinal development function. (tr-auth)

184

THE EFFECT OF ATMOSPHERIC TEMPERATURE VARIATIONS ON COSMIC-RAYS UNDERGROUND. Noah Sherman. Ph.D. Thesis, Univ. of Michigan, 1952.

The variations in the intensity of cosmic rays observed underground, in a Detroit, Mich., salt mine 1100 ft (846 m water equivalent) below the surface, are correlated with variations in temperatures in the stratosphere and at sea level, over the period from Apr. 1 to Nov. 30, 1951. The cosmic rays observed in the salt-mine were μ mesons and their products. The correlation analysis of the atmospheric temperatures and observed cosmic-ray intensity indicate that the π-μ decay model does not describe the origin of μ mesons of energy $\geq 10^{11}$ ev. If κ mesons are the parents of μ mesons of this energy, then a maximum value of 4×10^{-10} sec for the mean lifetime of κ mesons would be associated with a maximum temperature coefficient of 0.08%/°C. (G.Y.)

185

THE SPREAD OF THE SOFT COMPONENT OF THE COSMIC RADIATION. H. S. Green and H. Messel. Phys. Rev. 88, 331-8(1952) Oct. 15.

The fundamental diffusion equations describing the three-dimensional development of the electron-photon component of the cosmic radiation, are formulated. These equations take into account exactly ionization loss and variation of density in the medium, and enable one to determine all angular and radial moments of the distribution functions, as explicit functions of depth and energy for arbitrary initial conditions. The exact general solutions of these equations are readily adapted to any physical situation of interest. The method is similar to that devised by the authors in considering the three-dimensional development of the nucleon component. The only approximations involved are those inherent in the Bethe-Heitler cross sections in the full screening approximation, and the neglect of angular deflections in processes other than elastic coulomb scattering. No calculation of the actual distribution functions in the atmosphere or elsewhere has yet been made on the basis of a realistic physical model. The results obtained here will allow the authors to do this in the future. (auth)

186

ROCKET DETERMINATION OF THE IONIZATION SPECTRUM OF CHARGED COSMIC RAYS AT $\lambda = 41°N$. C. J. Perlow, L. R. Davis, C. W. Kissinger, and J. D. Shipman, Jr. Phys. Rev. 88, 321-5(1952) Oct. 15.

In a V-2 rocket measurement at λ - 41°N an analysis has been made of the various components of the charged-particle radiation on the basis of ionization and absorption in lead. The ionization was determined by two proportional counters, the particle paths through which were defined by Geiger counters. With increasing zenith angle toward the north, the intensity is found to be substantially constant until the earth ceases to cover the under side of the telescope. The intensity of all particles with range ≥ 7 g/cm^2 is 0.079 ± 0.005 (cm^2 sec steradian)$^{-1}$. Of this an intensity 0.012 ± 0.002 is absorbed in the next 14 g/cm^2. The ionization measurement is consistent with $\frac{3}{4}$ of these soft particles being electrons of $< \sim 60$ Mev, the remainder being slow protons and alpha particles. For the particles with greater range an ionization histogram is plotted, the smaller of the two ionization measurements for a single event being used to improve the resolution. The particles divide into protons, alpha particles, and one carbon nucleus, with $N_p/N_\alpha = 5.3 \pm 1.0$. Their absorption is exponential with mean free path 440 ± 70 g/cm^2 Pb. Extrapolating to zero thickness, the total primary intensity is 0.070 ± 0.005 (cm^2 sec steradian)$^{-1}$ with 0.058 ± 0.005 as protons, 0.011 ± 0.002 as alpha particles, and 0.001 ± 0.001 as $Z > 2$. (auth)

187

INTENSITY OF THE SOFT AND HARD COMPONENT OF THE COSMIC RADIATION AS A FUNCTION OF ALTITUDE AT GEOMAGNETIC LATITUDES OF 28°N, 41°N, AND 55°N. Marcello L. Vidale. Phys. Rev. 88, 266-72(1952) Oct. 15.

Counter telescopes have been flown with plastic balloons to a maximum altitude of 94,000 ft. Intensity vs. pressure curves have been obtained at geomagnetic latitudes of λ = 55, 41, and 28° for the total cosmic radiation and for the components capable of traversing several thicknesses of lead. The energy spectrum of primary cosmic-ray particles has been derived from the extrapolation of the intensity of the total radiation to the top of the atmosphere. The integral momentum spectrum of the total primary radiation is given by $N(>pc/Ze) = 0.49(pc/Ze)^{-1.8}$. The results show that the radiation originating from primaries in the energy range 1 to 4 bev (cut-off energies at λ = 55 and 41°) is predominantly of a nucleonic nature. The absence of an appreciable electronic component can be explained by assuming that, close to the top of the atmosphere, electrons originate predominantly from the decay of neutral mesons and that, within this energy range, the over-all probability of nucleon emission is greater than that of meson production. In sharp contrast, the soft component originating from primaries in the range from 4 to 8 bev (cut-off at λ = 41 and 28°) multiplies rapidly in the atmosphere. This large transition effect in air with a maximum at about 10 cm Hg pressure is very characteristic of electron showers. It is concluded that the probability of neutral mesons being produced is comparatively high at primary energies between 4 and 8 bev. At energies higher than 8 bev this effect is even more pronounced, due to the contribution of the plural and multiple production of mesons. (auth)

188

THE ABSORPTION MEAN FREE PATH OF LARGE HARD SHOWERS IN AIR. Harold K. Ticho. Phys. Rev. 88, 236-41(1952) Oct. 15.

An experiment is described in which altitude curves of hard showers of various sizes produced in a lead block were obtained. The sizes were determined by means of a hodoscope; for the largest hard shower group a minimum energy of 260 bev was estimated by extrapolation to the top of the atmosphere. All altitude curves show an exponential absorption in the atmosphere with a mean free path of ~125 g cm^{-2}. It appears that these large attenuation lengths are difficult to reconcile with a geometric collision mean free path for a nucleon-nucleus collision. (auth)

189

IONIZATION CHAMBER MEASUREMENTS OF THE ABSORPTION OF THE N-COMPONENT OF COSMIC RAYS IN LEAD. H. S. Bridge and R. H. Rediker. Phys. Rev. 88, 206-24(1952) Oct. 15.

A detecting system that responds only to ionization bursts produced by nuclear interactions of the so-called N component of cosmic radiation is described. The burst rate observed with this detector has been measured as a function of the thickness of lead absorber above the system at sea level and at 10,600 feet. The absorption of the N component in lead cannot be represented by an exponential variation of the intensity with absorber thickness; instead the "absorption curve" shows an initial increase in intensity. This behavior may be explained by the assumption that π mesons with energies of several bev, which are produced in the nuclear interactions, can give rise to further nuclear interactions. From the altitude variation of the smallest recorded bursts produced by the N component, one finds a value of 119 ± 5 g cm^{-2} for the absorption thickness of the producing radiation in air. The absorption thickness decreases with increasing energy of the nuclear event detected. In the same experiment, other kinds of events were also recorded, which could be produced either by N rays or by μ mesons. The bursts produced by these two components were separated on the basis of the experimental altitude variation of N rays and of the computed altitude variation of the μ-meson-induced bursts. For the particular ionization chamber, about 50 percent of the bursts at sea level produced by charged particles incident on the 219 g cm^{-2} lead ionization chamber shield were caused by μ mesons and 50 percent by the N component. (auth)

190

ASSOCIATED PAIRS OF PENETRATING PARTICLES AND OTHER EVENTS OBSERVED AT MOUNTAIN ALTITUDES WITH PHOTOGRAPHIC EMULSIONS. K. R. Dixit. Indian J. Phys. 26, 243-53(1952) May.

Ilford nuclear emulsions exposed at two places in the Himalayas at altitudes of 11,500 and 14,300 ft have been studied. All the events, singles > 100 μ and stars not obviously due to radioactive inclusions, are recorded. The singles appear to be produced by some radiation traveling in an almost vertical direction and which is twice as absorbable as the star-producing radiation. Observation of

all stars leads to the expectation that some stars normally excluded as of radioactive origin, on the criterion that a star smaller than sixfold is radioactive when all the six tracks are less than 60 μ, could have been produced by the cosmic radiation. The cosmic-ray stars appear to be produced in a cascade process. Rare events like associated penetrating particles are observed. Four events are observed which are interpreted as π meson production by interactions of V_0^1 particles with Li nuclei. The average mass of V_0^1 calculated from these events is 2166 m_e. (auth)

191

INTERPRETATION OF COSMIC-RAY MEASUREMENTS FAR UNDERGROUND. Paul H. Barrett, Lowell M. Bollinger, Giuseppe Cocconi, Yehuda Eisenberg, and Kenneth Greisen. Revs. Modern Phys. 24, 133-78(1952) July.

A series of experiments performed over a 2-yr period at a depth of 1574 m water equivalent in a salt mine near Ithaca, N. Y., are reported. The evidence indicating that at this depth the cosmic radiation is composed of ionizing particles similar in behavior to μ mesons, accompanied by a secondary soft component, is reviewed. Anticoincidence experiments are described which directly contradict the previous evidence suggesting a nonionizing character for the penetrating radiation. Correlation of intensity with depth, temperature, zenith angle, and extensive air showers; mechanism of the underground meson showers; and nuclear interactions produced by the penetrating component are discussed. Estimates of energy of the primaries causing the single mesons and the meson showers are assembled, and the absolute frequencies are calculated. These data provide two new points which are added to previous information on the number-energy spectrum of the primary cosmic rays. Evidence is presented that the primaries of energy around 10^{15} ev are composed mostly of protons and α particles rather than heavier nuclei. (G.Y.)

192

SIZE DISTRIBUTION OF COSMIC RAY STARS IN PHOTOGRAPHIC EMULSIONS. J. Y. Mei. Can. J. Phys. 30, 453-8 (1952) Sept.

In an analysis of cosmic-ray stars found in Ilford G5 emulsions exposed at about 85,000 ft the star-size distribution curve shows a change in slope at a prong number of about 8.5. A similar effect is shown for emulsions exposed at airplane altitudes, and it is assumed that the effect is mainly due to the composition of the emulsions. While the primary particles producing the stars at about 85,000 ft are mostly protons, about 50% of the low energy stars are produced by nonionizing radiation, presumably neutrons. α-Particles and heavier nuclei produce about 30% of the larger energetic stars. The absolute frequency of star production is given. (auth)

193

THE LOW ENERGY SPECTRUM OF COSMIC-RAY MESONS AT SEA LEVEL AT HIGH GEOMAGNETIC LATITUDES. D. C. Rose and A. G. Voisin. Can. J. Phys. 30, 373-87 (1952) Sept.

The differential range spectrum of cosmic-ray μ mesons has been measured by three different methods the first of which was used at two northern geomagnetic latitudes 56.8 (Ottawa) and 83.0 (Resolute in the Canadian Arctic). In the first method the integral spectrum was measured by absorption, and after various corrections the differential spectrum was derived. In the second method the number of particles stopped in a block of Pb was measured by a coincidence–anticoincidence arrangement of counters. In the third method the delayed coincidence method was used, the meson being identified by its decay electron. Over the range studied (ranges in Pb up to 700 g/cm^2) the results of the three methods are in general agreement and agree with others in that the smoothed data show only a small variation in intensity over the range studied. Some of the results suggest that a more detailed study of the spectrum might show some irregularities in the intensity variation with range. As would be expected no significant difference was found in the shape of the curves at the two stations. (auth)

194

THE CLOSE PAIR EFFECT IN COSMIC-RAY STARS. K. E. Davis, J. B. Marion, J. F. Delord, and K. M. King. Phys. Rev. 88, 368-72(1952) Oct. 15.

Evidence is presented to establish the existence of the close-pair effect in cosmic-ray stars formed in nuclear emulsions exposed at 95,000 ft. A reasonable estimate of the magnitude of the effect may be derived from the data obtained, and this magnitude is compared with that obtained from similar studies at lower altitudes. It appears that a maximum for the excess of close pairs occurs for separations $\leq$ 1 mm in the emulsions exposed at balloon altitudes. It is extremely difficult to explain the effect on the basis of present knowledge. (auth)

195

NOTE ON THE FLUCTUATION PROBLEM IN CASCADE THEORY. H. Messel and R. B. Potts. Proc. Phys. Soc. (London) A65, 854-6(1952) Oct. 1.

A general relation between two fundamental functions appearing in fluctuation problems in cascade theory is derived. This leads to a direct method of solving for the nth moments of the distribution function. It is also shown that the Jánossy G-equations are superfluous for the solution of the fluctuation problem. (auth)

196

ORIGIN OF INDIVIDUAL HIGH-GRAIN-DENSITY TRACKS OF COSMIC-RAY PARTICLES IN PHOTOGRAPHIC PLATES. H. Garski. Z. Naturforsch. a7, 565-70(1952) Aug. (In German)

Measurements of the tracks of individual protons and heavy particles in nuclear emulsion showed that, within an experimental error of 20%, the number of particles coming to rest in the emulsion per cubic centimeter per day is equal to the number of corresponding track origins of various types. About 60% of the particles ending in the film arise in stars with at least three prongs, and about 40% are produced in nuclear disintegrations emitting one or two ionizing particles or are accelerated by neutron scattering. The angular distribution of the tracks shows a marked preference for the vertical. The angular distribution found in this study should be identical with the known angular distributions of particles emitted in nuclear disintegrations and of protons accelerated by neutron scattering. At the present time a direct comparison is possible only in rough approximation. Agreement exists so far as the experimental material shows. (tr-auth)

CRYSTALLOGRAPHY AND CRYSTAL STRUCTURE

197

Carnegie Inst. of Tech.

THE STUDY OF PLASTIC DEFORMATION IN AN ORDERED Cu_3Au SINGLE CRYSTAL BY X-RAY MEASUREMENTS (thesis), by C. Eugene Dixon. Aug. 10, 1951. 103p. (U-19071)

An ordered Cu_3Au single crystal is pulled to an elongation of 65%. The orientation is such that the deformation process is single slip and the resolved shear strain at the maximum stress is 1.16. X-ray measurements of the change in dimensions of the antiphase domains and the change in long range order are made from superlattice reflections. It is found that there is a negligible change in the dimensions of the domains in a direction parallel to the slip plane, but the dimension normal to the slip plane is reduced. The change in antiphase domain size in a direction normal to the slip plane makes possible a calculation of the mean slip-plane

separation. This is found to be about 100 A at the maximum strain. Integrated intensity measurements indicate that 6% of the volume is disordered. The values of the slip plane separation and the fractional volume disordered are consistent with the assumption made previously by Blewitt that each slip plane disorders a volume of about two atom layers in its vicinity. A mechanism is suggested which could cause the cold-work disordering and an experiment is proposed which might determine the validity of the suggestion. The mean slip-plane separation of about 100 A seems to be lowest ever observed by a direct measurement, and the failure of other x-ray measurements to observe such small values is explained by evidence from this experiment that a slip plane will not reduce the size of the coherent region for ordinary x-ray reflections. The uniform array of dislocations commonly associated with a cold-worked metal to explain work hardening is not consistent with these experimental results. (auth)

ELECTRICAL DISCHARGE

198

Evans Signal Lab., Signal Corps Engineering Labs.

A "HIGH VACUUM" COLD CATHODE GASEOUS DISCHARGE: A CYCLOTRON EFFECT (thesis), by Israel R. Senitzky. Sept. 1, 1950. 40p. (U-15729)

An unusual type of cold cathode gaseous discharge is described which can take place at pressures estimated to be as low as 10^{-10} mm of Hg. The electrons absorb power from a weak r-f field, the positive ions absorb power from a d-c field, and the electron path is extremely long compared to the dimensions of the tube. The discharge, which manifests itself by a direct anode current, takes place in the presence of a magnetic field the magnitude of which is near the cyclotron value, as determined by the r-f frequency. Part 1 describes the apparatus with which the discharge was studied. In part 2, the behavior of the discharge as a function of the r-f and d-c electric fields, the magnetic field, and the gas pressure is discussed. Anode current flows only if the magnetic field is within a certain critical range near the cyclotron value, and exhibits 1 or more maxima within this range, depending on the operation conditions. Lower limits exist for both the d-c and r-f voltages, below which there is no self-sustained discharge. The least sustaining r-f power diminishes with decreasing pressure. Anode current increases with r-f voltage if the d-c voltage is below about 400 v. Above this voltage, the r-f field loses control and the discharge characteristics change. Part 3 covers the motion of an electron under the influence of d-c and r-f electric fields and analyses of a perpendicular magnetic field. The existence of a multiplicity of resonances near the cyclotron frequency is shown. The possibility of utilizing this type of discharge for the measurement of extremely low pressures and for the detection of low r-f power is indicated. (auth)

199

SELF-ABSORPTION IN ARC SOURCES IN THERMAL EQUILIBRIUM. H. Edels. Proc. Phys. Soc. (London) B65, 794-800(1952) Oct. 1.

An analytical determination of the self-absorption of a spectral line emitted by a source is not normally possible if account is taken of the spatial variations in the source of the excited atom concentrations and spectral line profiles. The problem is simpler for uniformly excited sources, for example sources in thermal equilibrium, but not for high-pressure arc sources normally assumed to be in thermal equilibrium, because of the existence of temperature gradients. In the paper an analysis is developed which shows that if such arcs are treated as uniformly excited, an error of less than 5% is introduced into the determination of the self-absorption of spectral lines, emitted by transitions between an upper state s and a lower absorbing state t, which satisfy the limits $h\nu_{sq}/kT_0 \geq 10$ and $\nu_{st}/\nu_{tq} \leq 0.5$, where q is the ground state and T_0 the axial source temperature. The theory is then applied to the experimental data for a high-pressure mercury-arc discharge and to new measurements of the line widths at 5461 and 4358 A. It is shown that the calculated value of the self-absorption at 5461 A agrees with the experimental value only when the line has a resonance profile. The existence of this form of profile is also indicated by considerations of the broadening processes in the discharge. (auth)

200

EXPLANATION OF THE EXTREMELY LOW OPERATING VOLTAGE OF A HIGH-FREQUENCY DISCHARGE BETWEEN FLAT PLATES. Fritz Schneider. Z. angew. Physik 4, 324-5(1952) Sept. (In German)

An attempt is made to explain the low operating voltage of a high-frequency discharge by inclusion of a restoring force in the equation of motion of the electrons. This restoring force is taken from the diffusion theory of plasmas. (tr-auth)

ELECTRONS

201

THE MECHANISM OF FIELD DEPENDENT SECONDARY EMISSION. Harold Jacobs, John Freely, and Frank A. Brand. Phys. Rev. 88, 492-9(1952) Nov. 1.

In recent experimental investigations, it was found that secondary emission ratios as high as 10,000 to 1 could be attained utilizing field dependent secondary emission from magnesium oxide. Early tests showed the mechanism causing the high gains to be fundamentally different from the more standard secondary emission phenomenon. The hypothesis was made that the mechanism of field-dependent secondary emission was a process similar to that of the "Townsend avalanche" occurring in gas discharges. As the surface of the dielectric film was bombarded with primary electrons, the high resistivity of the material in combination with the secondary emission current caused the surface to charge to the potential of the collector grid, producing a high field within the dielectric. Electrons released within the material could then gain enough energy to liberate additional electrons, and an avalanche-type process resulted. Experiments were conducted to test this hypothesis and each proved to be consistent with the above theory. The main content of these experiments can be summarized in the following statements: (1) The high yields appeared to be independent of the base material. This indicated that the surface or volume effects were most important, implying that a Fowler-type field emission from the base metal was not a significant factor. (2) In studying the secondary current as a function of field, the gas-discharge equations were found to be correct. These equations predicted a straight-line plot of the ln lnδ vs 1/E, and in addition, gave a close estimate of the magnitude of the secondary emission ratio. (3) By means of retarding-potential measurements, the energies and mean free paths of the emitted secondary electrons were determined. These data were in good agreement with the results in item (2). (4) The rise time for surface charging was determined by using square wave variations of bombarding currents, and was found to be consistent with the original hypothesis. (auth)

202

ELECTROSTATIC IMMERSION OBJECTIVE OF NEW TYPE WITH HIGH SEPARATING POWER. Albert Septier. Compt. rend. 235, 652-4(1952) Sept. 29. (In French)

In seeking to obtain a very strong extracting field, the author tried a system consisting of a plane cathode placed

behind a classical unipotential lens. The presence of numerous aberrations made it necessary to insert a diaphragm near the cathode to act as a slightly convergent wehnelt. A resolving power $\delta = 100$ mμ was obtained. (G.Y.)

203

APPLICATION OF THE THEORY OF NUMBERS TO THE MAGNETIC PROPERTIES OF A FREE ELECTRON GAS. M. C. Steele. Phys. Rev. 88, 451-64(1952) Nov. 1.

The methods of number theory are used to find the magnetic properties of a free electron gas. The mathematical procedure which connects number theory to quantum mechanics is given in detail since the same or a similar method may be useful in other problems of solid-state and nuclear physics. The magnetic-moment calculation is given in three parts. For the case in which surface states are not considered the results obtained are in agreement with those of previous workers. But when the use of a finite container (rectangular box) to hold the electrons is considered, it is no longer possible to neglect surface states. Through the use of the WKB approximation it is found that the surface states give rise to new size-dependent terms in both the oscillatory and nonoscillatory parts of the magnetic moment. The oscillatory corrections are generally negligible compared to the usual de Haas-van Alphen effect. However, the nonoscillatory correction, which is diamagnetic in character, can be larger than the Landau diamagnetism for properly chosen magnetic field strengths and containter sizes. The calculation is concluded with a consideration of the effect of the electron spin. It is found, in agreement with other workers, that the only effect of spin on the oscillatory part of the magnetic moment is to introduce a phase change of $\pm\pi$ in alternate terms. The "surface" diamagnetic correction due to a finite container is found to be independent of electron spin. Details on the use of the method of critical points for evaluating integrals asymptotically are given in the appendix. (auth)

204

NUMBER THEORY AND THE MAGNETIC PROPERTIES OF AN ELECTRON GAS. M. F. M. Osborne. Phys. Rev. 88, 438-51(1952) Nov. 1.

Theorems involving the correction terms of lattice-point problems in the theory of numbers are interpreted to derive the orders of magnitude of the oscillatory (de Haas-van Alphen effect) and non-oscillatory (Landau and surface diamagnetism) terms in the magnetic moment of a Fermi gas in a finite cylindrical container. The results are valid for systems from atomic dimensions up, and all values of the magnetic field. The different types of moment are different from strong and weak fields, and may depend, for small particles, on the nature of the surface potential at the walls of the container. The applicability of the method to physical problems, and the difficulties associated with statistical mechanical problems involving magnetic fields are discussed. 30 references. (auth)

205

MEAN FREE PATHS OF ELECTRONS IN EVAPORATED METAL FILMS. F. W. Reynolds and G. R. Stilwell. Phys. Rev. 88, 418-19(1952) Oct. 15.

Recent work on the evaporation of metals, particularly Cu and Ag, has made available thin films of these metals, in the thickness range from about 100 to 2000 A, which have resistivities and resistance-temperature coefficients predictable from existing theories. These results suggest approximate values for the mean free paths of the conduction electrons in these metals at room temperatures. (auth)

206

THE THEORY OF SECONDARY EMISSION. J. F. Marshall. Phys. Rev. 88, 416-17(1952) Oct. 15.

The cross section for the production of secondaries from energetic primary electrons is shown to have the same form as the Bethe (Ann. Phys. 5, 325(1930)) expression for the ionization of atoms, namely, $\sigma_q = (A/E)\ln(E/E')$, where E is the energy of the primary electron and A and E′ are parameters characteristic of the medium. A similar expression is obtained for the rate of energy loss of electrons passing through solids. These results are in contrast with previous ones which were interpreted to mean that both the rate of production of secondaries and the rate of energy loss should be practically independent of the energy of the primary. (L.M.T.)

207

THE DERIVATION OF PARAXIAL CONSTANTS OF ELECTRON LENSES FROM AN INTEGRAL EQUATION. H. Bremmer. Applied Sci. Research (Netherlands) B2, 416-28(1952)

The paraxial trajectories in electron lenses are derived from an integral equation. The Liouville-Neumann expansions of the solutions of this equation lead to expressions for the magnification, the focal distances, and the positions of the focal points and cardinal points. The numbers of integrations to be performed in the individual terms of the expansions used to describe lens characteristics are reduced to half, as compared with the normal treatment. The focal and cardinal points are defined as osculating elements similar to those introduced by Glaser (Z. angew. Math. Phys. 1, 363(1950)). (auth)

208

INITIAL DISTRIBUTION OF COMPTON ELECTRONS. H. E. Johns, D. V. Cormack, S. A. Denesuk, and G. F. Whitmore. Can. J. Phys. 30, 556-64(1952) Sept.

Modifications of the Klein-Nishina formula for the Compton effect are presented which give the energy distribution and the angular distribution of the recoil electrons. Electron distributions have been calculated for photon energies from 10 kev to 30 Mev. The distributions of the electrons produced by Co^{60} γ rays have been determined. (auth)

209

ERRORS OF THIRD ORDER IN CYLINDRICAL ELECTRON LENSES. N. I. Shtepa. Zhur. Tekh. Fiz. 22, 216-26(1952) Feb. (In Russian)

The author uses the method of trajectories (cf. O. Scherzer, Beitr. Elektronenoptik 33(1947); R. Hutter, J. Applied Phys. 18, 740(1947)) to find errors of third order due to distortion, spherical aberration, curvature of field, initial velocities of electrons, etc., in cylindrical electron lenses. (G.Y.)

210

THEORY OF WAVE PROPAGATION IN AN ELECTRON BEAM. L. N. Loshakov. Zhur. Tekh. Fiz. 22, 193-202 (1952) Feb. (In Russian)

The theory of electromagnetic wave propagation in the presence of an electron beam in a wave guide filled with dielectric is described. It is assumed that electrons move freely along the wave-guide axis within the dielectric. Types and peculiarities of waves capable of propagating under various conditions are established. (G.Y.)

211

THE ANOMALOUS MAGNETIC MOMENT OF THE ELECTRON. S. H. Koenig, A. G. Prodell, and P. Kusch. Phys. Rev. 88, 191-9(1952) Oct. 15.

The ratio of the electron spin g value and the proton g value has been measured with high precision. It is found that $g_s/g_p = 658.2288 \pm 0.0006$, where g_p is the g value of the proton measured in a spherical sample of mineral oil. This result, when combined with the measurement by Gardner and Purcell of the ratio of the electron orbital g value and the proton g value, yields for the experimental value of the magnetic moment of the electron $\mu_s = (1.001146 \pm$

0.000012)μ_0. The result is in excellent agreement with the theoretical value recently calculated by Karplus and Kroll: $\mu_s = (1.0011454)\mu_0$. (auth)

GASES

212

Atomic Energy Research Establishment, Harwell, Berks (England)

DRYING OF GASES AND DETERMINATION OF MOISTURE IN GASES; A SELECTED BIBLIOGRAPHY OF LITERATURE REFERENCES. 1951. 6p. (AERE-Inf/Bib-83)

Report AERE-G/M-89 and 59 literature references dealing with the above subject are listed. (H.G.)

213

Argonne National Lab.

THE IONIZATION OF GAS MIXTURES IN STELLAR INTERIORS: II. THE AVERAGE NUMBER OF ELECTRONS OCCUPYING VARIOUS SHELLS, by Geoffrey Keller and R. K. Meyerott. July 1952. 20p. (ANL-4856)

The average numbers of electrons occupying the principal shells of atoms of carbon, nitrogen, oxygen, aluminum, and iron are given for a number of temperatures and densities in mixtures that contain at least 75 wt. % hydrogen and helium. (auth)

214

HIGH FREQUENCY BREAKDOWN IN NEON. A. D. MacDonald. Phys. Rev. 88, 420(1952) Oct. 15.

The breakdown electric field in spectroscopically pure neon gas at frequencies in the 3000-Mc region has been measured in the pressure range of 0.5 to 300 mm of Hg. The breakdown fields, both experimental and theoretical, are shown graphically for cylindrical cavities of heights 0.317 and 0.634 cm. The equations used for the theoretical determinations did not yield exact solutions over the whole pressure range. (L.M.T.)

215

DRIFT VELOCITIES OF IONS IN KRYPTON AND XENON. Robert N. Varney. Phys. Rev. 88, 362-4(1952) Oct. 15.

Drift velocities and mobilities of ions of Kr and Xe in their respective parent gases have been measured over a wide range of values of E/p_0, the ratio of electric field strength to normalized gas pressure. Two ions appear in each gas identified as Kr^+ and Kr_2^+ in Kr and Xe^+ and Xe_2^+ in Xe. The relation that drift velocity varies as $(E/p_0)^{1/2}$ at high E/p_0 has been found to hold for the atomic ions and has been used to determine the equivalent hard-sphere cross sections at high fields. The cross sections are 157×10^{-16} cm^2 for Kr and 192×10^{-16} cm^2 for Xe. The Langevin theory of mobilities gives excellent agreement with experimental results extrapolated to zero field strength provided that, in the theory, the hard-sphere cross section is taken as large for the atomic ions and very small for the molecular ions. The range of the polarization forces is such as to render them insignificant in atomic-ion collisions and of primary importance in molecular-ion collisions. (auth)

216

CHARGE TRANSFER IN THE RADIATION CHEMISTRY OF GASES. Milton Burton and John L. Magee. J. Phys. Chem. 56, 842-5(1952) Oct.

Charge and excitation transfers play important roles in radiation chemistry, the mechanism of which can be examined most clearly for gases. In such transfer, complex formation is involved. Ion clusters so produced involve bonds of typical strength running up to 2 ev or more. A simplified calculation of their lives is described. The lifetimes in typical cases may be of the order of seconds. In such time, charge neutralization, internal conversion, chemical dissociation, and chemical reaction (including aggregation or polymerization) with other molecules may be important competing processes. For excitation transfer, the method of calculation of lives of complexes is formally the same but there are important quantitative differences. One important conclusion is that, in the radiation chemistry of gases, both ionization and excitation processes (including transfer) are significant. An apparent exception to this conclusion, the polymerization of acetylene vapor, is examined and an explanation consistent with these views is offered. (auth)

217

MOBILITIES OF POSITIVE IONS IN THEIR PARENT GASES. T. Holstein. J. Phys. Chem. 56, 832-6(1952) Oct.

In this paper a method is described for computing the mobility of an ion in its parent gas. Formulas of kinetic theory give the mobility in terms of the cross section for momentum transfer in an ion-atom collision. It is found that this cross section is, in most cases, determined predominantly by charge exchange, which takes place readily between an ion and a parent atom. The computations require knowledge of the "resonance" or charge-exchange component of the total ion-atom interaction; the latter is obtained by a new method whose sole prerequisite is a knowledge of the Hartree-Fock wave function of the outermost atomic shell. The theory has been applied to the cases of neon and argon. (auth)

218

CHARGE TRANSFER AND THE MOBILITY OF RARE GAS IONS. J. A. Hornbeck. J. Phys. Chem. 56, 829-31(1952) Oct.

Ion-atom collisions in the rare gases between an atomic ion and a parent gas atom, such as Ne^+ and Ne, involve quantum mechanical symmetry effects which though rigorously inseparable have been listed as (a) a force of resonance attraction, (b) a force of resonance repulsion, and (c) charge exchange. Drift velocity measurements at high fields show that this complicated interaction may be represented to a good approximation by the hard sphere model of kinetic theory in which the collision cross section is several times the viscosity cross section of the atoms themselves. (auth)

INSTRUMENTS

219

Los Alamos Scientific Lab.

A HIGH SPEED ROTATING MIRROR FRAME CAMERA, by Berlyn Brixner. [nd] Decl. Sept. 15, 1952. 15p. (AECD-3453; LADC-1212)

A high-speed framing camera of some general utility has been developed at the Los Alamos Scientific Lab. and operated up to 3,500,000 frames/sec. Use is made of a rotating mirror and 170 framing lenses working at f/26 to produce frame pictures 1.2×1.4 cm in size. Another model operating at 100,000 frames per second has been made with 90 circular frames 2 cm in size. (auth)

220

Los Alamos Scientific Lab.

DESIGN AND PERFORMANCE OF A RADIOFREQUENCY ION SOURCE, by Lester K. Goodwin. [nd] 14p. (LADC-1265)

Tests were made on a 27 megacycle, inductively coupled, r-f ion source standardized in design for use at the Los Alamos Scientific Laboratory. Total deuteron beam-current and probe-current characteristics were found in preliminary tests as a function of the gas pressure of the discharge, the r-f power input, the probe voltage, and the extraction-system geometry to determine the best values of these variables to use. A maximum total beam of 600 μa was obtained in the preliminary tests with roughly 200 watts of

r-f power input. Tests made after installation in four different accelerators gave 92% monatomic deuteron beams of up to 80% the strength shown in preliminary tests. A platinum-coated envelope gave a 50% triatomic beam of about one-eighth the strength of the monatomic beam obtained with an uncoated envelope. The source has been used at 150 psi external pressure in a Van de Graaff tank. (auth)

221

Columbia Radiation Lab., Columbia Univ.

THE SECOND QUARTERLY REPORT FOR THE YEAR 1952 TO THE SIGNAL CORPS SCIENTIFIC REPRESENTATIVE. June 30, 1952. 20p. (NP-4116; U24101)

Progress is reported in the following fields: (1) generation of high frequencies by molecular-beam oscillators, magnetrons, and Cherenkov radiation; (2) microwave techniques and detectors and harmonic generators; (3) hot grinding and hot hobbing as tube fabrication techniques; and (4) microwave physics, including the hfs structure of the H atom. (cf. TIP U22662) (TID-LC)

222

Columbia Radiation Lab., Columbia Univ.

THE FIRST QUARTERLY REPORT FOR THE YEAR 1952 TO THE SIGNAL CORPS SCIENTIFIC REPRESENTATIVE. Mar. 31, 1952. 28p. (NP-4117; U-22662)

Progress is reported in the following fields: generation of h-f oscillations by molecular-beam oscillators, magnetrons, and Cherenkov radiation; microwave techniques and detectors, and harmonic generators; hot grinding and hot hobbing as tube fabrication techniques; and microwave physics. (cf. TIP U21014) (TID-LC)

223

Baird Associates, Inc.

TECHNICAL REPORT COVERING THE PERIOD JUNE 1950 TO SEPTEMBER 1952 [ON PROBLEM OF FIXED FILTER DEVELOPMENT FOR TUNING PURPOSES], by Bruce H. Billings, Stanley J. Sage and Norman Hapgood, Jr. [nd] 90p. (NP-4125; U24400)

The characteristics of the multilayer Fabry-Perot filter (alternate layers of semitransparent Ag and dielectric) and the Fabry-Perot interferometer are described. The filters were fabricated by a technique yielding high reflectivities without absorption. Filter behavior was primarily a function of reflectivity; when the reflectivity was high, the bandwidth was narrow with better rejection at spectral regions away from the region of peak transmission. Filters having a bandwidth of 0.1 A and less and a transmission of the order of 20% were similar in performance to the multiplate birefringent filter. The utility of the multilayer filter in measuring the separation between the 1.7-μ Hg doublet demonstrated the feasibility of high-resolution interference spectroscopy in the infrared. Application of the tunable-filter Fabry-Perot techniques to isotope-concentration analysis indicated the necessity for a large free spectral range and a high reflectivity; greater evaporated-film flatness is required to achieve the requisite reflectivity. In the absence of high resolution, several spacers were employed. Tuning over a large wavelength region was attempted with a 3-plate filter using Z-cut quartz (circularly birefringent material); a band of about a 250-A half width was isolated. X-cut materials would permit the isolation of narrower transmission bands but cannot rotate a plane-polarized light beam. A synthetic duplicate of circular birefringent filters can be made by using a quarter-wave retardation plate oriented 45° to the crystal plate on the incident-light side and another rotated 90° from the first on the other side of the crystal plate. (cf. TIP U18087) (TID-LC)

224

DEVICES FOR CALIBRATION OF SLOW-COUNTING-RATE METERS. Ronald L. Ives. Nucleonics 10, No. 10, 64-6 (1952) Oct.

Description is given of the three calibrators designed for slow-counting-rate meters. Of the three, only one meets the minimum cost, bulk, and weight requirements. This one employs a standard repeating timer, consisting of an electric clock motor, a cam, and a microswitch, used in conjunction with a small regulated power supply, a capacitor, and an output transformer to produce the requisite pulses at rates within the desired range. It is of small bulk, requiring only a $5 \times 6 \times 9$-in. utility case and weighs only $7\frac{1}{2}$ lb. The instrument has given satisfactory performance over a four-month period. (L.M.T.)

225

A LOGARITHMIC COUNTING-RATE RECORDER. Denman Shaw and Ruth N. Weltmann. Rev. Sci. Instruments 23, 528-31(1952) Oct.

A counting-rate recorder is described which, in conjunction with a commercial scaler and associated circuits, will plot directly points that are proportional to the logarithm of the time for a predetermined number of counts. The record of the logarithm of the counting rate on a linear scale is obtained from the angle of rotation of a cylinder by means of a logarithmic spiral cut helically around the cylinder, where the angle of rotation corresponds to the time interval. Instrument errors are shown to be less than one percent. (auth)

226

PULSE-AMPLITUDE ANALYSIS IN NUCLEAR RESEARCH. IV. MULTICHANNEL ANALYZERS (CONTINUED). A. B. Van Rennes. Nucleonics 10, No. 10, 50-6(1952) Oct. (cf. NSA 6-6130)

Three multichannel analyzers are described in which pulse-height analysis is accomplished by an expander-amplifier driving a chain of discriminators, by conversion of amplitude to time, and by information-storage devices. The features, associated problems, and desirable characteristics of multichannel analyzers are summarized. 16 references. (L.M.T.)

227

COLLIMATING DEVICE FOR MEASURING GAMMA RAYS FROM A LIMITED REGION. Allen F. Reid and Ben Wilson. Nucleonics 10, No. 10, 72-3(1952) Oct.

The method utilizes heavy Pb shielding so as to selectively admit γ rays from a definite region and distance into the collimator. The actual detector measurements are of secondary radiations, since none of the incident γ rays enter the detector proper. A plug nearly filling a tapering hole defines a roughly conical passageway. Rays from a source near the small end of the hole can strike the wall to produce secondaries which continue into the detector but most of the rays from a more distant source can strike only the plug. (L.M.T.)

ISOTOPES

228

Rochester Univ.

THREE NEW NEUTRON DEFICIENT XENON ISOTOPES, by Bruce Dropesky and Edwin O. Wiig. Sept. 18, 1952. 6p. (NYO-3837)

When iodine was bombarded with 240-Mev protons, the three Xe isotopes Xe^{121}, Xe^{122}, and Xe^{123} were produced. Yields of I daughters at successive one-hr separations from the Xe parent showed the half lives of Xe^{121}, Xe^{122}, and Xe^{123} to be 40 ± 2 min, 20 ± 1 hr, and 1.7 ± 0.2 hr, respectively. (L.T.W.)

229
Rochester Univ.
THREE NEW NEUTRON DEFICIENT ISOTOPES OF YTTRIUM, by Edwin O. Wiig. Sept. 18, 1952. 3p. (NYO-3838)

Proton bombardment of pure Y oxide produced the three isotopes Y^{82}, Y^{83}, and Y^{85}. The Sr daughter isotopes were removed from the Y at periodic intervals and then followed for decay. The half-life values found for the Y isotopes were 70 ± 10 min for Y^{82}, 5 ± 1 hr for Y^{85}, and 3.5 ± 0.5 hr for Y^{83}. (L.T.W.)

230
Oak Ridge National Lab.
MASS SPECTROMETER STUDY OF TECHNETIUM, by John R. Sites, Russell Baldock and L. O. Gilpatrick. Aug. 26, 1952. 14p. (ORNL-1327)

A sample of approximately 5 mg of solid ammonium pertechnetate was examined in a mass spectrometer to set the best possible upper limit to the existence of isotopes of masses 97, 100, and 101. Fission-product residues were the source of the nearly pure technetium salts. Upper limits were set with respect to Tc^{99} as follows: Tc^{97}, 1/2000; Tc^{100}, 1/5000; and Tc^{101}, 1/5000. Incidental to this study several interesting observations were made of the types of ion formation peculiar to technetium compounds as well as on the large number of valence states. (auth)

231
ISOTOPE SHIFTS IN ERBIUM. Lawrence Wilets and Lee C. Bradley, III. Phys. Rev. 87, 1018-22(1952) Sept. 15.

An investigation of the erbium isotope shifts has been conducted in the region between 4000 and 7000 A using the dispersion of a Fabry-Perot interferometer crossed with a Steinheil three-prism glass spectrograph. Structures were measured in 68 lines, and components due to the even isotopes Er^{166}, Er^{168}, and Er^{170} have been identified. The ratio of the isotope shifts $(\nu_{168}-\nu_{170})/(\nu_{166}-\nu_{168})$ is close to unity in nearly all lines measured, and it is concluded that the undisturbed value of the ratio probably does not differ from unity by more than 4 percent. Electron configurations have been proposed to describe the observed shifts; in particular, those lines in which the component due to Er^{170} is shifted to larger wave numbers than the components due to the other even isotopes, probably arise from the two-electron transitions $4f^{11}6s6p$ to $4f^{11}5d^2$. (cf. NSA 6-1930) (auth)

ISOTOPE SEPARATION

232
SEPARATION OF ISOTOPES BY ELECTROLYTIC MIGRATION OF IONS. A. Klemm. J. chim. phys. 49, C18-C24 (1952) June. (In French)

Numerous published experiments on the isotopic enrichment in various systems by ionic migration are summarized, the apparatus being sketched for most of the examples. An empirical expression for the mass effect is derived. (G.Y.)

233
ON THE CONCENTRATION OF HEAVY WATER IN GLACIER ICE. Arne Eld Sandström. Arkiv Fysik 3, 549-56(1952). (In English)

The small glaciers of the north Scandinavian mountain range were investigated to ascertain whether a high concentration of D_2O is present. The results show that water from the ice of the glaciers has a density higher than that of ordinary subsoil water. This excess varies between 0.02 and and 0.10%, corresponding to an enrichment of not less than five times the normal concentration of D_2O. The average excess of D_2O is of the same order of magnitude as that of the ice from other glaciers. (L.T.W.)

234
EQUILIBRIUM BETWEEN PROTIUM, DEUTERIUM AND TRITIUM IN THE SYSTEM: HYDROGEN–ACETIC ACID; ISOTOPIC FRACTIONATION FACTORS IN A CATALYTIC HYDROGENATION. Maxwell Leigh Eidinoff, Joseph E. Knoll, David K. Fukushima, and T. F. Gallagher. J. Am. Chem. Soc. 74, 5280-4(1952) Nov. 5.

Isotopic distribution coefficients in the equilibria at 25°C of: H_2 + AcOH′ (l) ⇌ HH′ + AcOH (l) have been measured, where H′ refers to deuterium and tritium. Equilibrium constants were calculated for the corresponding gas reactions using these isotopic forms of acetic acid. This isotopically equilibrated hydrogenation system was used in the presence of Pt catalyst to saturate the double bond in methyl 3α-acetoxy-Δ^{11}-cholenate. The isotopic composition of the hydrogen atoms incorporated during the hydrogenation was measured relative to the isotopic composition of the carboxyl hydrogen of the acetic acid medium. These results indicate that the exchange between dissolved and carboxyl hydrogen at the catalyst surface is rapid relative to the hydrogenation steps. Relative to the hydrogen gas composition, the heavier isotopes are preferentially incorporated into the compound undergoing hydrogenation by a factor of 1.10 and 1.26 for deuterium and tritium, respectively. Relative to the carboxyl hydrogen composition, protium is preferentially incorporated by a factor of 3.31 and 5.42 with respect to deuterium and tritium, respectively. (auth)

MASS SPECTROGRAPHY

235
Hanford Works
MASS SPECTROMETRIC DETERMINATION OF DEUTERIUM IN WATER, by C. A. Goodall and G. J. Alkire. Aug. 20, 1952. 8p. (HW-25258)

A method is described for the precision determination of D_2O in water for concentrations ranging from 0.01 to 99.9 mole % D_2O. A series of standard water samples of Columbia River H_2O and D_2O (from Biological Research group) were equilibrated with H and the gas analyzed by a Consolidated-Nier mass spectrometer to obtain a working curve of the 3 peak/2 peak ratio vs. mole % D. The Columbia River H_2O was likewise equilibrated and analyzed to confirm the zero intercept of the plot. Corrections for the contributions of the D in the natural water and the H_3^+ to the 3 peak/2 peak ratio were thus determined empirically. The D_2O samples analyzed by this method were found to contain 97.6 mole % D. (L.M.T.)

236
ATOMIC MASSES FROM PALLADIUM THROUGH XENON. Richard E. Halsted. Phys. Rev. 88, 666-72(1952) Nov. 1.

The atomic masses of 42 stable nuclides in the region from palladium through xenon have been measured with a double-focusing mass spectrometer. Combined with nuclear reaction mass differences the data provide a table of 74 mass values between mass numbers 102 and 136. A fit of the Wigner semi-empirical mass formula to these values reveals an irregularity at the magic number of 50 protons similar in nature to those previously reported from this laboratory at 20 and 28 protons. Also evident is an inability of the formula to account for the binding-energy variations between isobaric nuclei. An empirical modification of the formula is observed to correct largely for this latter effect. (auth)

237
RADIOFREQUENCY MASS SPECTROMETER FOR UPPER AIR RESEARCH. J. W. Townsend, Jr. Rev. Sci. Instruments 23, 538-41(1952) Oct.

Electronic circuits have been designed for the Bennett type

of r-f mass spectrometer so that it may be used in an experiment devised to obtain the composition of the upper atmosphere. The rocket-borne spectrometer samples the spectrum between mass numbers 48 and 5 once per second with a resolution of one part in twenty-five. Data may be obtained between pressure limits of 8×10^{-4} and 2×10^{-6} mm Hg, corresponding to ambient pressures between 100 and 160 km, respectively. The entire instrumentation weighs less than 50 pounds and occupies a total of 1.4 cubic feet. (auth)

238

SOME ATOMIC MASSES FOR TELLURIUM. Benjamin G. Hogg and Henry E. Duckworth. Can. J. Phys. 30, 628-9(1952) Sept.

The mass differences $\frac{1}{2}Te^{122} - Ni^{61}$, $\frac{1}{2}Te^{124} - Ni^{62}$, $\frac{1}{2}Te^{128} - Ni^{64}$, and $\frac{1}{2}Te^{130} - Cu^{65}$ were measured with a double-focusing mass spectrograph. These data have been combined with existing information on the masses of Ni and Cu isotopes and relative masses of the Te isotopes to give weighted, most-probable values for the atomic masses of Te^{122}, Te^{124}, Te^{128}, and Te^{130}. Adjusted masses of Te^{123}, Te^{125}, and Te^{126} also were computed. Experimental values and results of parallel calculations based on two values for the mass of C^{12} are tabulated. (G.Y.)

239

NOTE ON THE RESOLVING POWER OF MASS SPECTROMETERS. Larkin Kerwin. Can. J. Phys. 30, 503-11(1952) Sept.

In calculating the resolving power of a homogeneous-field mass spectrometer, the dispersion and the beam width of the instrument must be considered. The latter is the sum of at least 10 components, which are discussed. Formulas giving the resolving power of three types of spectrometer of current interest are developed, as well as formulas for positioning the exit slits. (auth)

240

PROPOSED METHOD FOR PRODUCING SHORT INTENSE MONOENERGETIC ION PULSES. R. C. Mobley. Phys. Rev. 88, 360-1(1952) Oct. 15.

A method is outlined whereby suitable periodic deflection over the range of possible path lengths between foci of an appropriate focusing magnet is utilized to convert a continuous monoenergetic ion beam at one focus into very short-duration high-intensity monoenergetic ion pulses at the other focus. Time-of-flight analysis of reaction particle pulses resulting from the interaction of the ion pulses with stationary target nuclei is discussed, and the application of this method to the elastic and inelastic scattering of neutrons is considered briefly. (auth)

MATHEMATICS

241

THE SLOPE OF LOGARITHMIC PLOTS OF THE FOWLER-NORDHEIM EQUATION. J. M. Houston. Phys. Rev. 88, 349(1952) Oct. 15.

The slope of logarithmic plots of the Fowler-Nordheim equation for electron field emission is expressed in terms of the surface work-function and a tabulated function, s(y). This new function s(y) is derived from Nordheim's v(y) which appears in the exponent of the Fowler-Nordheim equation. Values of v(y) are also tabulated and are believed to be more exact than Nordheim's original values. (auth)

MEASURING INSTRUMENTS AND TECHNIQUES

242

Ames Lab.

APPLICATION OF SCINTILLATION COUNTERS TO BETA-RAY SPECTROSCOPY, by James P. Palmer and L. Jackson Laslett. Dec. 1950. 69p. (ISC-174)

The requirements for a phosphor for β-ray spectroscopy are considered. Anthracene was chosen as a particularly useful phosphor for this work. A scintillation coincidence spectrometer is described. This device was constructed so that it could be used as a scintillation spectrometer without coincidence. A theoretical investigation of the performance of the instrument for monokinetic beta particles is made and leads to resolution corrections of the experimental beta spectra. End-point determinations of beta spectra can be made with this instrument to an accuracy of 8% or better. End-points for Ag^{113} and Ag^{112} have been found to be 2.0 and 4.2 Mev, respectively. By β-γ coincidence spectrometry, the inner beta spectrum of Rb^{86} has been found to have an end-point at 674 kev, within about 15 per cent. At a maximum x-ray energy of 70 Mev, using the Iowa State Coll. synchrotron to produce Ag^{112} and Ag^{113} from Cd^{113} and Cd^{114}, respectively, the ratio of the cross section of Ag^{113} to Ag^{112} is found to be 1.5. The relative yield of Ag^{113} to Ag^{112} equals 2.2. The instrument can investigate activities having about 1/1000 the intensity of those needed for magnetic spectrometers, although its accuracy is not as good. (H.F.G.)

243

Material Lab., New York Naval Shipyard

FINAL REPORT ON INVESTIGATION OF PULSES FROM GEIGER-MUELLER TUBES OPERATED UNDER MINIMUM LOADING CONDITIONS USING STATISTICAL TECHNIQUES, by W. G. Egan and G. E. Davis. Apr. 10, 1952. 31p. (NP-4084)

In connection with the development of equipment for use in the evaluation of G-M tubes, the Material Laboratory has conducted an investigation of pulses obtained from G-M tubes operated with minimum loading. Four types of tubes were investigated: G-M Tube Types 5979/BS-1, 5980/BS-2, GL-15, and GLM-15. An analysis of the registration of spurious peaks, occurring later than 250 microseconds after the initial pulse, was made using statistical techniques and the data given by an NRL type plateau tracer. The results, presented in tabular and graphical form, indicate that these spurious peaks are registered by this tracer. The relation between applied voltage and the relative increase in observed count rate due to registration of spurious peaks is determined with sufficient accuracy to allow the following general conclusions to be drawn: The NRL type plateau tracer responds to spurious peaks which appear in the G-M tube pulses. The number of spurious peaks registered increases rapidly as the applied voltage is raised beyond the value at which the peaks first register. Large errors in counting can result when the number of spurious peaks is large. These errors will affect particularly the high-voltage end of the plateau traced by the NRL type tracer, shortening the acceptable plateau length. (auth)

244

Chalk River Project (Canada)

PROGRESS REPORT [FOR] MAY 16, 1952 – SEPTEMBER 30, 1952; ELECTRONICS BRANCH, by J. Hardwick. [nd] 20p. (PR-P-15-E)

Progress is briefly reported on the investigation of the dispersal of radioactive gases from the plant and on instrument development. (L.T.W.)

245

Radiochemical Center, Amersham, Bucks (England)

THE MEASUREMENT OF MICRO-MICROCURIE AMOUNTS OF RADON BY A SCINTILLATION COUNTING METHOD, by J. Bryant and M. Michaelis. Sept. 10, 1951. 26p. (RCC/R-26)

The problem of assaying micro-microcurie amounts of Rn is considered with special reference to the measurement of Rn content of exhaled breath samples from Ra workers. An apparatus is described which uses a scintillation counting technique. In addition to the assay of Rn con-

tent of air, the apparatus may also be used for the measurement of Ra content of solutions using a de-emanating technique. (auth)

246

Naval Radiological Defense Lab.
EVALUATION OF THE AN/PDR-37 (XN-1) RADIAC METER, by G. A. Work and C. E. Parker. Aug. 18, 1952. 20p. (USNRDL-364)

A portable radiac instrument in which the conventional indicating meter is replaced by a sound signal is evaluated in terms of its technical characteristics and tactical utility. Various types of radiac indicators are analyzed and the general conclusion is drawn that a meter indicator most nearly satisfies the requirements placed upon these devices. (auth)

247

DIRECT MEASUREMENT OF PARTICLE TRACK LENGTH IN PHOTONUCLEAR EMULSION. M. K. Juric and Z. A. Smokovic. Rev. Sci. Instruments 23, 564-5(1952) Oct.

An ordinary microscope was modified so that its tube could be rotated on the left and on the right around an axis (0-X) lying in the plane of the plate surface. A snail gear enables putting the tube at the desired angle. An ordinary objective (100X with immersion) which could reach a maximum inclination of the tube of 13° was used. By measuring the track by means of the eyepiece scale, the tube is put perpendicular to the direction of the track which enables direct measurement of the whole length. Since the length is different from the true range due to shrinkage of the emulsion after processing, the plate must be soaked after fixation and washed in a 10% solution of glycerine. (L.T.W.)

248

AMPLITUDE FLUCTUATIONS OF ELECTRONIC AND IONIC IMPULSES GENERATED BY PASSAGE OF A SHOWER OF RELATIVISTIC PARTICLES THROUGH AN IONIZATION CHAMBER. M. I. Podgoretskiĭ. Zhur. Eksptl'. i Teoret. Fiz. 22, 160-3(1952) Feb. (In Russian)

The considerable fluctuations in the amplitudes of electron and ion pulses in an ionization chamber and fluctuations in the ratio of the indicated amplitudes are computed. (tr-auth)

249

CONTRIBUTION TO THE DOSAGE DETERMINATION OF β RADIATION FROM RADIOACTIVE SUBSTANCES. K. Sommermeyer. Strahlentherapie 88, 329-44(1952). (In German)

After incorporation into the body of substances emitting β-rays, the therapeutic and diagnostic problem often arises of estimating the biological effect of the β rays in the body at a given distribution of the β emitters. This biological effect depends on the dose and the specific ionization produced in each point inside the body. At a known distribution of the β emitters, the dose and the specific ionization can be computed without too much trouble from measurements of ionization of the air by β emitters. The author also describes a simple ionization method for determining the activity of radioactive solutions. (auth)

250

DOSIMETRY OF RADIOACTIVE SUBSTANCES. A SIMPLE METHOD OF MEASURING THE SPECIFIC ACTIVITY OF RADIOACTIVE SOLUTIONS. K. Sommermeyer. Strahlentherapie 88, 345-51(1952). (In German)

A small cylindrical open ionization chamber is brought near the surface of radioactive solutions for the purpose of measuring the share contributed by the β radiation to the current passing through the chamber. The portion of current deriving from the β radiation is nearly proportional to the product of the specific activity and the average β energy, if the chamber has the appropriate dimensions. By means of this arrangement it is, therefore, possible to determine in a very simple way the specific activities of radioactive solutions, including solutions of isotopes with very small β energies such as S^{35} and C^{14}. The technical details of this procedure are discussed in full. (auth)

251

A QUICK METHOD OF DISTORTION MEASUREMENT IN NUCLEAR EMULSIONS. J. V. Major. Brit. J. Applied Phys. 3, 309-10(1952) Oct.

A rapid method for measuring the curvature distortion in the tracks of cosmic-ray particles in photographic emulsions is described. The method involves the determination of the separation, at mid-height in the emulsion, of the track from the chord joining its ends, and is applied to the determination of curvature distortion contours on a 400-μ-thick G5 nuclear research plate. (auth)

252

A NEW METHOD OF USING IONIZATION CHAMBERS. W. D. Parkinson and V. F. Hess. Rev. Sci. Instruments 23, 565-6(1952) Oct.

In the conventional method of using an ionization chamber the needle of an electrometer is kept in contact with the collecting electrode, which is always near ground potential, and the chamber walls are maintained at a fixed voltage V from ground, causing a bound charge CV on the collector, where C is the capacity between the collecting system and the chamber walls. When working out-of-doors the problem of keeping C and V constant is accentuated. A method which overcomes this difficulty is described. (L.T.W.)

253

A CONDENSER TYPE ION CHAMBER FOR THE MEASUREMENT OF GAMMA-RADIATION IN THE PRESENCE OF THERMAL NEUTRONS. Edgar B. Darden, Jr., C. W. Sheppard, and L. C. Emerson. Rev. Sci. Instruments 23, 568-9(1952) Oct.

An ionization chamber constructed of Be and Teflon and based on the Sievert condenser principle is described. The central electrode is charged relative to the surrounding shell, and following exposure the discharge is read on an electrometer. The gas is allowed to flow through the chamber for a few minutes to drive out the air while the chamber is connected to the charging voltage. The chamber is then removed from the electrometer, the plug screwed in, the nozzle disconnected, and the port cover twisted to seal in the gas. In the interval between the last two operations equilibrium is established between the gas pressure and the outside air. (L.T.W.)

254

A COMPARISON OF IODINE-131 COUNTING METHODS. H. D. Bruner and Jesse D. Perkinson, Jr. Nucleonics 10, No. 10, 57-61(1952) Oct.

Data and description are given of the comparative efficiency and sensitivity of nine methods of counting betas and gammas of I^{131}. These include the Marinelli 2π counter, "Texas" 4π counter, high-pressure ion chamber, quartz-fiber electroscope, mica end-window counter (liquid and dry samples), scintillation counter (liquid and dry samples), and gas-flow proportional counter methods. It is emphasized that the data given are the results for the instruments available, and are not presented as the best the instruments can do. 16 references. (L.M.T.)

255

FILM MEASUREMENT OF BETA RADIATION DOSE. Evelyn S. Jetter and Hanson Blatz. Nucleonics 10, No. 10, 43-5(1952) Oct.

The validity of film measurement of β-radiation dose in work with U was determined by (1) the variation of film density with β dose using electron beams of different energy, and (2) β radiation emitted from a U metal source absorbed

through different filter thicknesses, and the film and air ionization measurements for the different source conditions compared. In each case film ionization was found to be proportional to ionization in air; hence it was concluded that the film method is reliable for measuring the β-radiation dose from U. (L.M.T.)

256

MEASUREMENTS OF GRAIN DENSITIES OF HIGH-ENERGY PARTICLE TRACKS RECORDED IN PHOTOGRAPHIC EMULSIONS; DETERMINATION OF THE IONIZATION MINIMUM. L. Jauneau and F. Hug-Bousser. J. phys. radium 13, 465-72 (1952) Oct. (In French)

Measurement by grain counting of the ionization tracks produced by fast charged particles in nuclear emulsion has been investigated. Causes of errors limiting the precision of these measurements, e.g., personal coefficients of the observers and unevenness of development, are considered, and fluctuations of the number of grains along the track are analyzed. Selection of the ionization minimum and calculation of the grain-density error with respect to the density minimum permits the problem of the increase in ionization with track length to be attacked and answered, use being made of tracks produced by primaries of stars and by shower particles (protons, mesons, and μ-meson disintegration electrons). (tr-auth)

257

SOME PROBLEMS IN RADIOCARBON DATING. Ernest C. Anderson and Hilde Levi. Kgl. Danske Videnskab. Selskab Mat. fys. Medd. 27, No. 6 (1952). 22p. (In English)

A detailed comparison of the screen-wall counter with a gas sample counter with respect to the problems of radiocarbon dating is given. Curves are presented showing the accuracy and range of the method as functions of the background rate and the counting time. The errors due to intrusion of extraneous carbon are presented and discussed, and certain improvements in the method are described. (auth)

258

STATISTICAL CORRELATIONS CONNECTED WITH RECORDING OF IONIZATION PULSES. M. I. Podgoretskiĭ. Zhur. Eksptl'. i Teoret. Fiz. 22, 152-9(1952) Feb. (In Russian)

Problems concerning the number of false pulses connected with background in an ionization chamber and the influence of background on observed magnitude of operating pulses are considered. Equations are derived for basic methods of ionization chamber use such as the threshold method, continuous oscillograph, and convection-current measurement ($RC \ll t$, where t is collection time). (G.Y.)

259

EFFICIENCY OF THE LONG BORON COUNTER FOR FAST NEUTRONS. S. A. Kushneriuk. Can. J. Phys. 30, 402-11 (1952) Sept.

The efficiency of the long boron counter is calculated as a function of the incident neutron energy using the two-group model of neutron diffusion in conjunction with the age and exponential approximations for the slowing down of neutrons. The neutron energies considered are $\leq$10 Mev. Results are summarized graphically for several counter geometries. (auth)

260

DOSIMETRY OF THE β RADIATION OF RADIOACTIVE ISOTOPES IN HOMOGENEOUS SUBSTANCES. K. Sommermeyer. Z. Physik 133, 201-8(1952). (In German)

The physical and measurement-technique problems to which dosimetry of the β radiation of incorporated radioactive isotopes leads are discussed. It is important to ascertain the dosage and specific ionization (in the β-particle tracks) in the region of the β emitter. A simple and generally applicable procedure is given for solution of these problems. This is carried out for some special cases. In addition, a simple method for determination of the activity of radioactive solutions is reported. (tr-auth)

261

SCINTILLATION COUNTER FOR ALPHA PARTICLES. PULSE DISTRIBUTION FOR 4.8 MEV ALPHA PARTICLES IN ANTHRACENE. P. Bener. Helv. Phys. Acta 25, 463-4 (1952) Sept. 15. (In German)

The differential pulse distribution for an anthracene crystal and 5819 photomultiplier tube arrangement detecting collimated Po α particles is drawn. This spectrum is much narrower than that given by Bell (Phys. Rev. 73, 1405 (1948)). Relation of number of photoelectrons to width of the pulse distribution is discussed. (G.Y.)

262

A NEUTRON COUNTER USING PROTON RECOILS FROM A SOLID HYDROGENOUS RADIATOR. Yngve Axner and Bengt Swenson. Arkiv Fysik 3, 499-506(1952). (In English)

An ionization chamber with a solid hydrogenous radiator for neutron measurements is described. The theoretical calculation of the sensitivity is experimentally verified with D–D neutrons. The spectrum of the recoil-protons is measured with a 10-channel pulse amplitude analyzer. (auth)

263

THEORY OF A NEUTRON COUNTER USING PROTON RECOILS FROM A SOLID HYDROGENOUS RADIATOR. Yngve Axner. Arkiv Fysik 3, 491-8(1952). (In English)

The sensitivity for a neutron counter is calculated using proton recoils from a solid hydrogenous radiator. The following assumptions have been made. The pulses from the chamber are proportional to the energy loss of the protons in the chamber gas. The range of the protons in the radiator is $R = R_0(E/E_0)^2$. The neutron-proton scattering is spherically symmetrical in the c.m. system. (auth)

264

SCINTILLATORS AND ENERGY TRANSFER PROCESSES. C. Reid. Phys. Rev. 88, 422-3(1952) Oct. 15.

The conditions necessary for efficient scintillation processes in various organic molecules in solution are summarized according to (1) solvent-solvent transfer, (2) solvent-solute transfer, and (3) emission of radiation. Results show that, in general, the molecules of inefficient scintillators show self-transfer in inert solvents at low temperature, whereas those of the efficient ones do not. (L.M.T.)

265

LINEARITY OF MONOCHROMATIC γ RADIATION IN A SCINTILLATION SPECTROGRAPH. D. Maeder and V. Wintersteiger. Helv. Phys. Acta 25, 465-7(1952) Sept. 15. (In German)

The amplitude response curves of cylindrical NaI crystals of various sizes, having length equal to radius, when irradiated along the cylindrical axis with 0.1- to 1-Mev γ rays have been calculated, consideration being taken of secondary effects. Good agreement with experiment is shown. (G.Y.)

266

A METHOD FOR CHEMICAL DETERMINATION OF γ RAYS IN THE PRESENCE OF SLOW NEUTRONS. Madeleine Corval, Adolphe Chapiro, and Charles Cousin. Compt. rend. 235, 799-801(1952) Oct. 13. (In French)

The disappearance of 1,1-diphenyl-2-picrylhydrazyl (DPPH) in solutions irradiated for long periods with γ rays or neutrons has been followed colorimetrically (NSA 6-145) to measure the intensities of these radiations when not mixed. Use of a perdeuterated solvent containing only C, D, and O should prevent Szilard-Chalmers reactions, thus permitting the γ rays to be measured in the presence of neutrons as in a pile. Twelve-hour exposures in the

Châtillon pile of solutions of DPPH in CH_3OH and CD_3OD resulted in respective consumptions of $41 \pm 2 \times 10^{-8}$ and $3 \pm 2 \times 10^{-8}$ moles of DPPH/ml, after correcting for reaction of the reagent with the methanol. With methyl acetate and methyl acetate-d_6 as solvent, consumption of DPPH was $99 \pm 3 \times 10^{-8}$ and $26 \pm 2 \times 10^{-8}$ moles/ml, respectively. The technique will be used to measure the distribution of γ-ray intensities in the interior of the pile. (G.Y.)

267

THE USE OF SCINTILLATION COUNTERS IN THE MEASUREMENT OF THE ENERGY OF X-RAYS AND LOW ENERGY GAMMA-RAYS. Sven A. E. Johansson. Arkiv Fysik 3, 533-45(1952). (In English)

The possibility of using scintillation counters to measure the energy of γ rays and x rays, down to 10 kev, as well as continuous x-ray spectra, was investigated. The radiations from Ce^{141}, Os^{193}, Hg^{203}, and from an x-ray tube were studied. The results indicate that the scintillation counter is a useful instrument for the measurement of low energies. (L.T.W.)

268

BETA SPECTROMETER WITH TWO MAGNETIC LENSES AND INTERNAL CORRECTING COILS. V. S. Shpinel. Zhur. Eksptl'. i Teoret. Fiz. 22, 255-6(1952) Feb. (In Russian)

A β-ray spectrometer is sketched, and a curve obtained therewith of the conversion electrons of 90-hr Nb^{95m} is presented. The K/L conversion-coefficient ratio was found to be 2.5 ± 0.5. (G.Y.)

MESONS

269

Cosmic Ray Lab., Univ. of Puerto Rico

TECHNICAL REPORT NO. 1 ON RANGE DISTRIBUTION OF SEA LEVEL MESONS AT LOW GEOMAGNETIC LATITUDES, by L. del Rosario and J. Dávila-Aponte. June 15, 1952. 18p. (NP-4113; Bull. No. 4; Technical Report No. 1; U-23782)

The shape of the meson differential spectrum at sea level was studied at a geomagnetic latitude of 29°N. Delayed-coincidence and anticoincidence methods were used; the range interval was from about 10 to 320 g/cm^2 air equivalent. The spectrum curve was flat without the 200 g/cm^2 maximum obtained in several other experiments and as evidenced by the differential range curve prepared by Rossi. However, these results referred to experiments conducted at geomagnetic latitudes around 45°N. No completely satisfactory explanation for the discrepancy was obtained. (TID-LC)

270

Rochester Univ.

CHARGE INDEPENDENCE AND MULTIPLE PION PRODUCTION, by L. Van Hove and R. E. Marshak, Rochester Univ. and A. Pais, Institute for Advanced Study, Princeton. Oct. 15, 1952. 5p. (NYO-3703)

The consequences of charge independence for multiple pion production in nucleon-nucleon and in pion-nucleon collisions are discussed. Relationships are derived connecting the various cross sections involved. (L.T.W.)

271

Johns Hopkins Univ.

LIFETIMES OF THE MU-MESON IN HEAVY ELEMENTS, by L. Zernow and L. Madansky, p.37-8 of ANNUAL REPORT ON STUDIES OF NUCLEAR GAMMA RAYS, by L. Madansky and F. Rasetti. Sept. 1, 1952. 2p. (NYO-3901(p.37-8))

The system used for the determination of the lifetime of the μ^- meson in Pb was described previously (NYO-674). The lifetime was determined as 66.5 ± 11 mμsec, after correction for the large background. This is not inconsistent with the value of 72 ± 5.2 mμsec, reported by Harrison, Keuffel, Godfrey, and Reynolds (Phys. Rev. 86, 616A(1952)). (L.M.T.)

272

Radiation Lab., Univ. of Calif., Berkeley

THE RATIO OF POSITIVE TO NEGATIVE MESON PRODUCTION FROM DEUTERIUM, by J. Carothers and C. G. Andrè. Sept. 16, 1952. 6p. (UCRL-1940)

The ratio of positive to negative π-meson production from D at 0° to a 340-Mev proton beam was measured by a method permitting a direct comparison of the positive and negative production. The mesons were separated from the proton background by using a double magnet arrangement. The D target was kept at 1400 psi and liquid-N temperature. The ratios observed were obtained by measuring the meson production from the container plus gas at a series of energies, reversing the fields in both magnets, and measuring the mesons produced at the same energies. The gas was then removed from the container and similar measurements were made for production from the end windows of the target. (L.T.W.)

273

Radiation Lab., Univ. of Calif., Berkeley

ON THE PLUS-MINUS RATIO FROM PROTON BOMBARDMENT OF DEUTERIUM, by Malvin A. Ruderman. Oct. 2, 1952. 4p. (UCRL-1963)

The relation between the ratio of π^+ to π^- mesons, produced from the proton bombardment of D_2, and the meson and nucleon spins is briefly discussed. (L.T.W.)

274

Radiation Lab., Univ. of Calif., Berkeley

SUMMARY OF RESEARCH PROGRESS MEETING OF OCTOBER 2 AND OCTOBER 9, 1952, by Sergey Shewchuck. Oct. 22, 1952. 7p. (UCRL-1992)

A Space Charge Accelerator for Protons. J. R. Woodyard. The practicability is discussed of using, in a device 10 m long, the new method of H. Alfvén for particle acceleration in which the coulomb field in the vicinity of a dense electron cloud moving with an appropriate speed supplies the high field strength. Availability of the π^- Meson Beam at the Cyclotron. B. Moyer. Features of the π^- beam from the 184-in. cyclotron which have been observed by scintillation-counter-telescope techniques are described. Identification of quadrupole coincidences was made by the following tests: (1) the range measurement was appropriate to π^- mesons of the proper energy, (2) the last two crystals of the telescope were moved back along the orbit 7 ft from the first two and a time-of-flight determination was made upon the particles giving coincidences, and (3) when the last two crystals in the time-of-flight position were lifted out of the plane, the counts sharply decreased. (L.T.W.)

275

NEGATIVE PION ACTIVATION OF BROMINE. T. T. Sugihara and W. F. Libby. Phys. Rev. 88, 587-8(1952) Nov. 1.

Radiochemical studies of the reactions of π^- mesons with bromine, silver, and the light elements present in photographic emulsions should assist considerably in the interpretation of data obtained with photographic plates. The results for bromine with 122-Mev negative pions expending their full range in the element include: Peak yield of about 7 percent for As^{78} (ejection of 1 proton and 2 or 4 neutrons depending on which Br isotope absorbs the pion); the ratio of the number of neutrons to the number of protons ejected was three to four in the most probable cases; the distribution of radioactivities appears to be reconcilable with photographic-plate data if one guesses that the silver data will resemble those for bromine. (auth)

276

THE V-PARTICLE AND THE COMPOSITE PION. R. J. Finkelstein. Phys. Rev. 88, 555-8(1952) Nov. 1.

It is assumed that the V particle is described by a spinor wave function, and that the pion may be treated as a nucleon-antinucleon pair. The rates of the following reactions

$$\left.\begin{matrix}\pi\rightarrow\mu+\nu\\ V^0\rightarrow\pi+P\end{matrix}\right\},\ \text{now written as}\ \left\{\begin{matrix}(P+\bar{N})\rightarrow\mu+\nu\\ V^0\rightarrow\bar{P}+N)+P'\end{matrix}\right.$$

are then compared under the assumption that both reactions are governed by the same form and strength of β interaction. The ratio of the two lifetimes is independent of all numerical details of the pion structure. Putting in the observed lifetime of the pion, one finds for the lifetime of the V: 5×10^{-10} sec for Q = 35 Mev and 2×10^{-10} sec for Q = 75 Mev. The two Q values have been interpreted in terms of a mass doublet. (auth)

277

π^0 PRODUCTION CROSS SECTION FOR 430-MEV PROTONS ON H AND Be. J. Marshall, L. Marshall, V. A. Nedzel, and S. D. Warshaw. Phys. Rev. 88, 632-41(1952) Nov. 1.

The differential cross section for the production of photons in the forward direction by the reaction (430-Mev $p+H\rightarrow p+p+\pi^0$; $\pi^0\rightarrow 2\gamma$) is measured as 0.20×10^{-27} cm^2/sterad. The ratio of total to differential gamma cross section does not depend strongly on the symmetry of pion emission. Using an average calculated ratio, we find the pion-production cross section from hydrogen to be 0.45×10^{-27} cm^2. The differential gamma-production cross section in the forward direction on Be is measured to be 4.35×10^{-27} cm^2/sterad. We assume that in analogy with the case of H the ratio of total to differential photon cross section will not depend on symmetry of pion emission. Using the ratio calculated for isotropic emission we find $\sigma_{\pi^0}=8.7\times10^{-27}$ cm^2. (auth)

278

DETERMINING SPIN OF CHARGED π MESONS. I. M. Shmushkevich. Zhur. Eksptl'. i Teoret. Fiz. 22, 251(1952) Feb. (In Russian)

It is pointed out that the spin of charged π mesons can be determined from the relation

$$\sigma(p+d\rightarrow H^3+\pi^+)=\frac{2s+1}{3}\frac{p^2_\pi}{p^2_d}\sigma(\pi^++H^3\rightarrow p+d),$$

where s is the spin of the π^+ meson, and p_π and p_d are the momenta of meson and deuteron in the c.m. system. The spin of the π^- meson can be determined analogously from the reaction $n+d\rightarrow He^3+\pi^-$. (G.Y.)

279

PHOTOPRODUCTION OF MESONS IN DEUTERIUM. Melvin Lax and Herman Feshbach. Phys. Rev. 88, 509-15(1952) Nov. 1.

The production of positive mesons by photons incident on deuterium is calculated in terms of an effective hamiltonian containing one term which is independent of and another which depends upon the nucleon spin. The meson spectrum at a given angle to the incident photon beam is evaluated at high-photon energies by the closure approximation. At low and intermediate energies the closure approximation is not made, but the neutron-neutron force in the final nucleon state is neglected. These spectra have been integrated over a bremsstrahlung spectrum. The total cross section is found at high photon energies and near the threshold for meson production. It is found that the meson spectrum for small angles is sensitive to the relative size of the spin-dependent and spin-independent terms. (auth)

280

THE ENERGY SPECTRUM OF POSITRONS FROM THE DECAY OF THE μ-MESON. H. J. Bramson, A. M. Seifert, and W. W. Havens, Jr. Phys. Rev. 88, 304-8(1952) Oct. 15.

The energy of the positrons from 301 $\pi\rightarrow\mu\rightarrow\beta$ decays have been determined in electron-sensitive emulsions by measuring the multiple scattering of the positron tracks. The annihilation properties of the charged particle emitted in the decay of the μ^+ meson confirm its identity as a positron. This spectrum has a maximum about 36 Mev and a nonzero cutoff at the high energy end. A statistical analysis of the data, using the Michel theory (Proc. Phys. Soc. (London) 63, 514(1950)), yields a value of $\rho=0.41\pm0.13$. (auth)

281

THE LIFETIMES OF THE π^+ AND π^- MESONS. R. P. Durbin, H. H. Loar, and W. W. Havens, Jr. Phys. Rev. 88, 179-83(1952) Oct. 15.

The mean lives of the π^+ and π^- mesons are determined by measurements of the attenuation in flight of a 73-Mev meson beam, using a scintillation counter telescope of variable length. The decay scheme, $\pi^\pm\rightarrow\mu^\pm+\nu$, is assumed to be isotropic in the rest system of the π meson. The data, when the Lorentz time dilation is taken into account, give for the mean lives at rest, $\tau_-=2.55\pm0.19\times10^{-8}$ sec, and $\tau_+=2.44\pm0.18\times10^{-8}$ sec. (auth)

282

THEORY OF CAPTURE OF π PARTICLES BY DEUTERONS. I. Ya. Pomeranchuk. Zhur. Eksptl'. i Teoret. Fiz. 22, 129-35(1952) Feb. (In Russian)

The relative probabilities of the processes $p+\pi^-\rightarrow n+\pi^0$ and $d+\pi^-\rightarrow n+n+\pi^0$ are calculated from published experimental data without recourse to meson theory. Similar treatment is given to the relative probabilities of the radiative captures $p+\pi^-\rightarrow n+\gamma$ and $d+\pi^-\rightarrow n+n+\gamma$. It is shown that exact measurement of the relative numbers of π^0 mesons in the p and d processes may permit establishment of the parity and spin of π and π^0 mesons. (G.Y.)

283

SLOW π-MESONS IN COSMIC-RAY STARS AND THE NEGATIVE-POSITIVE π-MESON RATIO. J. Y. Mei and E. Pickup. Can. J. Phys. 30, 430-7(1952) Sept.

In a survey of mesons ending in emulsion no τ or κ mesons have been observed so far. The variation of the negative-positive π-meson ratio with energy shows up the effect of the coulomb barrier on π-meson production at very low energies. The variations of this ratio at mountain and balloon altitudes are discussed. Examples have been obtained of the emission of slow π mesons in hydrogen collisions in the emulsion, and also in energetic stars with several shower particles and few evaporation particles. (auth)

284

MESON PRODUCTION AS A SHOCK WAVE PROBLEM. W. Heisenberg. Z. Physik 133, 65-79(1952). (In German)

Multiple meson production by collision of two nucleons is treated as a shock wave process for which is constructed a nonlinear wave equation. The quantum mechanical aspects of the process can be approximated, consideration of the correspondence principle being necessary because of the higher quantum numbers involved. From a discussion of solutions of the nonlinear wave equations, conclusions are drawn concerning energy and angular distributions for the various types of mesons. (tr-auth)

285

PHOTOMESONS FROM THE DEUTERON. Joseph A. Thie. Phys. Rev. 88, 420-1(1952) Oct. 15.

The theory of Chew and Lewis (Phys. Rev. 84, 779(1951)) is applied in the calculation of the coincidence cross section

between a meson or its decay product and a recoiling nucleon of the disintegrated deuteron. It is desirable to do this in order that theory might be compared with the results of Keck and Littauer (Phys. Rev. 88, 139(1952)) on π^- meson production and also in anticipation of possible future study of π^0 mesons from neutrons by this method. (auth)

286

OBSERVATION OF A μ-MESON WITH SHORT RANGE. W. Riezler and A. Rudloff. Z. Naturforsch. a7, 570-1(1952) Aug. (In German)

Nine π-μ decays in which the entire μ-meson tracks were visible were observed in Ilford C2 emulsion exposed at 2963 m altitude. Eight of the tracks had the normal range 575 ± 35 μ, whereas one had a range of only 458 μ. A curve of grain density vs. range showed a sharp break corresponding to an energy loss of 0.55 Mev. Since no noticeable change of direction occurred, a momentum change of 1.2×10^{-16} g-cm/sec is indicated. Collision with a nucleus, rather than emission of photon, neutrino, or electron, would be necessary to satisfy these energy-momentum conditions. (G.Y.)

287

ENERGY LOSS OF COSMIC-RAY MU-MESONS IN SODIUM IODIDE CRYSTALS. Alvin Hudson and Robert Hofstadter. Phys. Rev. 88, 589-96(1952) Nov. 1.

A scintillation counter telescope, employing three NaI(Tl) crystals in coincidence, has been used to study the energy losses experienced by mu-mesons in traversing one of the crystals. The magnitude of the light flash in NaI(Tl) has been assumed to be proportional to the energy lost in the crystal by the meson. The observed pulse distribution is compared with one calculated on the basis of the Bethe-Bloch theory without the density correction and also with the Halpern-Hall theory (Phys. Rev. 57, 459(1940)) which includes the effect of the dielectric shielding. Each calculated curve employs a fold of the Landau straggling theory (J. Phys. (U.S.S.R.) 8, 201(1944)) with the cosmic-ray mu-meson spectrum. Comparison of the data with the two theories definitely favors the Halpern-Hall theory both in respect to absolute value of the most probable energy loss as well as the shape of the distribution. (auth)

NEUTRONS

288

SPALLATION OF Cu WITH HIGH ENERGY NEUTRONS. Luis Marquez. Phys. Rev. 88, 225-7(1952) Oct. 15.

The yields of spallation products of copper with high-energy neutrons have been measured and are given. The results are similar to those obtained with high-energy protons. This similarity and some apparent differences are pointed out. (auth)

289

DIFFUSION OF NEUTRONS. George Jaffe. Phys. Rev. 88, 603-11(1952) Nov. 1.

The object of the investigation was to include the thermal motion of the medium in the treatment of neutron diffusion, under the simplifying assumption that the collisions are such as between hard elastic spheres. The methods used were those previously established by the author in radiative and gas-kinetic transfer. They only had to be adapted to the present purpose. This is done in Sec. II. Boltzmann's original equation which is quadratic in the distribution functions is linearized by the assumption that the velocity distribution of the molecules is Maxwellian. The treatment of the resultant transport equation is different for thermal and for fast neutrons. Section III deals with thermal neutrons by the method of "moments." The distribution function is assumed to be of the form: Maxwellian factor times arbitrary function of direction, the latter written as a series of general spherical harmonics. Thereby, and by the use of a theorem due to Maxwell, the fundamental equation may be reduced to an infinite system of linear differential equations which have been previously treated. The case of arbitrary geometry is treated to second-order moments (inclusive). For the case of cylindrical symmetry a recurrence relation for the moments, to any order, is derived. In Sec. IV the case of fast neutrons is treated by the method of iterated integrations. In order to make them straightforward the kernel of the integral equation is transformed into the standard form. This is achieved by characterizing the collisions in a way which is different from that usually applied. A simple example for the working of the method is given and the results are discussed. (auth)

290

ON NEUTRON DIFFRACTION PHENOMENA ACCORDING TO THE KINEMATICAL THEORY. I. I. Waller and P. O. Fröman. Arkiv Fysik 4, 183-9(1952). (In English)

The diffuse temperature scattering of slow neutrons in single crystals, when the Laue interference condition is approximately satisfied, is discussed. The methods used in the analysis are similar to those in the corresponding theory for the x-ray case previously published by I. Waller (Interferenz- und Dispersionstheorie der Röntgenstrahlen (Uppsala, 1925). (L.T.W.)

291

ON NEUTRON DIFFRACTION PHENOMENA ACCORDING TO THE KINEMATICAL THEORY. II. Per Olof Fröman. Arkiv Fysik 4, 191-202(1952). (In English)

The influence of heat vibrations on the scattering of slow neutrons by small single crystals is discussed. The problem is closely connected with the corresponding problem for x rays, both as to methods and results, but it is more complicated because the frequency of the scattered neutrons is generally not equal to that of the incident neutrons. (L.T.W.)

292

THE ANGULAR DISTRIBUTION OF PROMPT NEUTRONS EMITTED IN FISSION. J. S. Fraser. Phys. Rev. 88, 536-41(1952) Nov. 1.

The angular distribution, relative to the direction of motion of the fragments, of the prompt fast neutrons emitted in the thermal-neutron fission of U^{233}, U^{235}, and Pu^{239} has been measured. Collimated fission fragments were selected in energy in a gridded-ionization chamber and coincident prompt neutrons in a given direction were counted by proton recoils in an electron-collecting chamber filled with methane. The distributions obtained selecting only light fragments have been compared with curves computed on the basis of the evaporation of the neutrons from the moving fragments of the most probable mode. Reasonably good agreement is obtained if one postulates that in the fission of each of the three nuclides studied, the neutron-emission probability is about thirty percent greater for the light fragment than for the heavy one. An upper limit of 4×10^{-14} sec following fission may be placed on the time of emission of the neutrons. (auth)

293

ESTIMATION OF NEUTRON ENERGY FOR FIRST RESONANCE FROM THERMAL-NEUTRON ABSORPTION CROSS SECTIONS. Donald Bogart. Nucleonics 10, No. 10, 35-9 (1952) Oct.

The physical data are given for 34 isotopes for which the thermal-absorption cross section, $\sigma_{a_{th}}$, and the neutron energy for the first resonance, E_R, have been assigned with reasonable assurance. $\sigma_{a_{th}}$ is plotted against E_R for these 34

isotopes with even-even, even-odd, odd-even, and odd-odd nuclei indicated as such. With odd-odd Li and N excepted, a plot of these values reveals a general tendency for $\sigma_{a_{th}}$ to decrease with increasing E_R. The same general relation holds for the data of 9 paired isotopes likewise plotted. This general dependence of $\sigma_{a_{th}}$ on E_R is then explained by neutron resonance theory, with good approximation of the experimental data. 18 references. (L.M.T.)

NUCLEAR PHYSICS

294

NUCLEAR STRUCTURE AND NUCLEAR FORCES. Victor F. Weisskopf. Z. Physik 133, 276-85(1952). (In English)

The author discusses briefly the problems involved in determining the nature of nuclear forces and understanding nuclear structure. It is evident from the discussion that the present knowledge of nuclear forces is extremely rudimentary and that the structure of nuclei is still unexplained. (G.Y.)

295

SPIN-ORBITAL INTERACTION OF NUCLEONS. V. P. Silin. Zhur. Eksptl'. i Teoret. Fiz. 22, 136-9(1952) Feb. (In Russian)

Operators for the interaction energy of two nucleons for the case of neutral scalar and neutral pseudoscalar theory with derivativeless couplings are found in an approximation that is quadratic in the coupling constant. (G.Y.)

296

STUDIES IN jj-COUPLING. II. FRACTIONAL PARENTAGE COEFFICIENTS AND THE CENTRAL FORCE ENERGY MATRIX FOR EQUIVALENT PARTICLES. A. R. Edmonds and B. H. Flowers. Proc. Roy. Soc. (London) A214, 515-30 (1952) Oct. 9.

Jahn's method of fractional parentage coefficients is adapted to obtain fully antisymmetric wave functions for the configurations j^n of neutrons and protons, where $j = 3/2, 5/2, 7/2$, and $n = 3$ and 4. Invariant theory is used to obtain linear combinations of Slater integrals which have special transformation properties with respect to the unitary and symplectic groups. In this way it is shown how the ordering of levels in jj-coupling with short-range central interactions is determined by the eigenvalues of Casimir's operator. (auth)

297

THE SPHERICAL SHELL NUCLEAR MODEL. H. A. Wilson. Proc. Roy. Soc. (London) A214, 446-51(1952) Oct. 9.

It is found that the spherical shell nuclear model has new energy levels due to the interaction of the vibrations and the rotation. Each vibration level has a series of equally spaced levels belonging to it. The levels of Al^{28} and Si^{28} are compared with the values predicted by the theory and good agreement is found. (auth)

NUCLEAR PROPERTIES

298

Argonne National Lab.

NUCLEAR SPIN OF $_{95}Am^{241}$, by Mark Fred and Frank S. Tomkins. [nd] Decl. Nov. 6, 1952. 1p. (AECD-3462; ANL-OCS-288)

The spectrum of Am^{241} has been photographed with a 30-foot spectrograph and found to contain many lines with wide hyperfine structure in the form of flag patterns, all apparently with six components. In lines that are well resolved there is a low degradation in spacing and intensity, and since the J values are expected to be high, the number of components is presumably spin-limited, with $I = 5/2$. The existence of an appreciable quadrupole moment is indicated by a noticeable departure from the interval rule for some lines. (Entire report)

299

Atomic Energy Research Establishment, Harwell, Berks (England)

STUDIES IN jj-COUPLING. III. NUCLEAR ENERGY LEVELS, by B. H. Flowers and A. R. Edmonds. May 1952. 17p. (AERE T/R-917)

The wave functions for the configurations j^n, with $j = 3/2$, $5/2$, and $7/2$, obtained in paper II [AERE-T/R-875; NSA 6-4925] of this series according to the particular scheme of paper I [AERE-T/R-713; NSA 5-5832], are here used to obtain the central-force energy matrices for nuclear configurations. The ordering of energy levels is studied as a function of the nature of the force with especial reference to its range, and the results are presented in the form of energy-level diagrams. The ordering of levels predicted to hold in papers I and II when forces are of short range is shown to occur with practical ranges; but for light nuclei in particular it is demonstrated that levels of very high angular momentum may sometimes occur near to the ground state. The results are found to be largely independent of the precise nature of the forces, provided they are of reasonably short range and are attractive in the ^1S state of two like particles; for definiteness, however, the diagrams have been drawn for a Rosenfeld symmetrical exchange force of gaussian radial dependence. The effect of using other types of central interaction is discussed qualitatively. The lowest excited states of even-even nuclei are seen to have a simple interpretation in jj-coupling. (auth)

300

Atomic Energy Research Establishment, Harwell, Berks (England)

STUDIES IN jj-COUPLING. IV. THE $g_{9/2}$-SHELL, by B. H. Flowers. June 1952. 8p. (AERE T/R-963)

The work of the first three papers of this series is here extended to the configurations $g^n_{9/2}$ of like particles. Wave functions are obtained for three particles, and energy-level diagrams are plotted as functions of the range of the force for two and three particles. The $7/2$ level of seniority three is shown never to be the ground state. This result is in conflict with the experimental findings and suggests a breakdown in the jj-coupling approximation. (auth)

301

Research Lab. of Electronics, Mass. Inst. of Tech.

THE MAGNETIC MOMENT AND HYPERFINE STRUCTURE ANOMALY OF K^{40}, by Joseph T. Eisinger and Benjamin Bederson. Jan. 28, 1952. 32p. (NP-4123; Technical Report No. 212; U24409)

The ratio of the nuclear gyromagnetic ratios of K^{40} and K^{39} was measured by an atomic-beam, magnetic-resonance method using a high-resolution r-f spectrometer. The average value for the ratio was -1.24346 ± 0.00024. The nuclear moment of K^{40} was measured independently of this ratio by determining the applied magnetic field and mean frequency of the K^{40} doublet and applying the Breit-Rabi formula. The value obtained was -1.2964 ± 0.0004 n.m. The gyromagnetic ratio of K^{40} was then calculated to be 0.32410 ± 0.00010. The hyperfine separation, $\Delta\nu$, of K^{40} was determined from the maximum mean frequency of the doublet to be 1285.790 ± 0.007 Mc. Results are compared with pertinent theoretical formulas and values obtained by other experimenters; they give support to nuclear models based on the independent particle model with spin-orbit coupling. 21 references. (TID-LC)

302

Wesleyan Univ.

ATOMIC MASSES FOR ELEMENTS WITH Z > 21; FINAL REPORT, by Henry E. Duckworth. Apr. 18, 1952. 45p. (NYO-981)

This table of masses, although incomplete, gives a picture of some of the variations in binding energy among the heavier nuclides and is, therefore, of help in the study of nuclear stability, particularly nuclear shell structure. The list provides information helpful in transmutation experiments. The list, because of its gaps, may bring attention to certain nuclear reactions whose study would yield significant mass information. It is intended that the table should supersede for the heavier nuclides the now out-of-date tables of Bethe (Elementary Nuclear Theory (John Wiley and Sons, Inc., New York, 1947)) and Wapstra (L. Rosenfeld, Nuclear Forces (Interscience Publishers, Inc., New York, 1949)). (106 ref.) (L.T.W.)

303

Rochester Univ.

ELASTIC SCATTERING OF 6.5 MEV PROTONS FROM COPPER, by L. M. Goldman. Sept. 25, 1952. 13p. (NYO-3226)

The 6.5-Mev protons from the 27-inch Rochester cyclotron have been used to determine the angular distribution of protons elastically scattered from copper. Significant differences from pure coulomb scattering were observed. The results have been compared with the predictions of the Feshbach, Weisskopf schematic theory and appear to disagree with these. (auth)

304

Rochester Univ.

ANGULAR DISTRIBUTIONS OF PROTONS FROM THE REACTION $F^{19}(d,p)F^{20}$, by D. A. Bromley, J. A. Bruner, and H. W. Fulbright. Oct. 2, 1952. 9p. (NYO-3700)

A Teflon (CF_2) target was bombarded with 3.6-Mev deuterons from the Rochester 26-inch cyclotron, and the angular distributions of the resulting proton groups were determined using an ionization chamber detector. The following table gives the angular momentum transfer (determined by comparison with the Butler curves) and the cross sections corresponding to the indicated levels in F^{20}:

Ground state	$l_n = 0$ and 2	$\sigma = 0.92 \pm 0.18$ mb/ster (at 45°)
0.65-Mev level	$l_n = 2$	$\sigma = 7.15 \pm 1.4$ mb/ster (at 45°)
2.05-Mev level	$l_n = 2$	$\sigma < 8$ mb/ster (at 45°)
3.49 and 3.53 (?)-Mev level	$l_n = 0$	$\sigma = 116 \pm 23$ mb/ster (at 7°)

These F^{20} states were found to have even parity, and the ground state spin was determined to be 1. (auth)

305

RADII OF MIRROR NUCLEI. Robert R. Wilson. Phys. Rev. 88, 350-1(1952) Oct. 15.

A nuclear model is used in which the nucleon density is a constant out to the core radius R and then decreases as $e^{-\alpha r}/r^2$, where $\alpha^2 = 8MW/\hbar^2$, in which W is taken as the average binding energy per nucleon. Values of R are determined from the measured energy differences between mirror nuclei by calculating the coulomb energy difference on the above model. If one assumes that the density of the core is constant with changing A, then $R = 1.36 \times 10^{-13}A^{1/3}/(1 + 3/\alpha R)^{1/3}$ and fits the data well. This also gives values of nuclear radii in agreement with those obtained from the recent electron-scattering measurements of Lyman, Hanson, and Scott even for large A. For light elements, a good approximation to the average nuclear radius, $R + 1/\alpha$, is $1.4 \times 10^{-13}A^{1/3}$. Nearly half of the nucleons are in the exponential tail. (auth)

306

NUCLEAR A LEVELS (FIRST EXCITED STATES). Salomon Rosenblum and Manuel Valadares. Compt. rend. 235, 711-13(1952) Oct. 6. (In French)

The first excited states of even-even nuclei resulting from α emission have been reported to have spins of 2. It is now pointed out that their excitation energies vary smoothly as a function of Z and I, where $I = A - 2Z$. This is shown on a plot for the region Pb to Cm of $\Delta E/E_0$ vs. $Z - (\Delta I)^2/20$, where ΔE is the excitation energy of the first excited state and E_0 is the energy of the corresponding α decay, any intervening β decay or electron capture being ignored. The authors propose designating the first and second excited states by the letters A and B, respectively. (G.Y.)

307

RELATIVE CROSS SECTIONS FOR THE EXCITATION OF ISOMERIC AND GROUND STATES BY THE (p,n) REACTION. F. Boehm, P. Marmier, and P. Preiswerk. Helv. Phys. Acta 25, 599-604(1952) Sept. 15. (In German)

The cross-section ratios σ^*/σ for the (p,n) formation of isomeric and ground states of Sc^{44}, Mn^{52}, Br^{80}, Kr^{79}, Sr^{85}, Y^{87}, Zr^{89}, Tc^{95}, Rh^{104}, Ag^{110}, In^{114}, Te^{121}, Xe^{127}, and Hg^{197} by bombardment of thin foils of the parent element with 6.7-Mev protons were determined. The mechanism of the (p,n) reaction through the intermediate nucleus is discussed, spin changes and energy levels between isomeric and ground states being considered. (G.Y.)

308

TOTAL CROSS SECTIONS FOR 14-Mev NEUTRONS. J. H. Coon, E. R. Graves, and H. H. Barschall. Phys. Rev. 88, 562-4(1952) Nov. 1.

The total cross sections of over 50 elements were measured, in good geometry, for 14-Mev neutrons. A plot of the square root of the total cross section versus the one-third power of the atomic weight shows deviations from the linear relationship predicted by statistical theory. The deviations are most pronounced for the heaviest elements. (auth)

309

SPINS OF CERTAIN ODD-ODD NUCLEI. Claude Marty and Jacques Prentki. Compt. rend. 235, 654-5(1952) Sept. 29. (In French)

The spins of certain nuclei from Cl^{34} to Bi^{210} have been estimated on the basis of the following hypotheses: (1) filled shells with one proton and one neutron in the following subshell; (2) existence of a simple central contact potential V between these two nucleons. From an analysis by the method of Slater (Phys. Rev. 34, 1293(1929)) the following relations were found. For the configurations $s_{1/2}j$ the two states $J = j \pm \frac{1}{2}$ have the same binding energy. For $p_{3/2}$ or $d_{3/2}$ configurations for the peripheral neutron and proton, the order of levels is $V_0 > V_1 = V_3 > V_2$, which means that the level J = 0 is more strongly bound than the equal-energy levels J = 1 and J = 3, which in turn are more strongly bound than J = 2. For one neutron and one proton in a $d_{5/2}$ shell, $V_0 > V_1 > V_3 > V_2 > V_4$. For one nucleon in the $d_{5/2}$ orbit and the other in $g_{7/2}$, $V_1 > V_6 > V_2 > V_4 > V_3 > V_5$. For one nucleon in $d_{5/2}$ and the other in $g_{9/2}$ or $h_{9/2}$, $V_7 > V_5 = V_3 > V_4 > V_6$. Predictions of spin from these relations are satisfactory for the heavier nuclei, but not for the light ones, such as Cl^{34} or Cu^{62}, for which hypothesis (2) probably is not valid. (G.Y.)

310

PARAMAGNETIC RESONANCE IN POTASSIUM CHROMICYANIDE. K. D. Bowers. Proc. Phys. Soc. (London) A65, 860-1(1952) Oct. 1.

The paramagnetic resonance spectra of single crystals of diamagnetic $K_3Co(CN)_6$ or $K_3Mn(CN)_6$ containing 0.1 to 1% of $K_3Cr(CN)_6$ were determined and analyzed. In a crystal containing Cr enriched in Cr^{53} a hyperfine structure of four lines of equal intensity was clearly resolved at 90 and 20°K, confirming the value $\frac{3}{2}$ for the nuclear spin. The probable value of the nuclear magnetic moment μ of Cr^{53} was found to be 0.5 ± 0.1 n.m. (G.Y.)

311
ROTATIONAL MAGNETIC MOMENT, MAGNETIC SUSCEPTIBILITIES, AND ELECTRON DISTRIBUTION IN THE HYDROGEN MOLECULE. N. J. Harrick and N. F. Ramsey. Phys. Rev. 88, 228-35(1952) Oct. 15.

Measurements have been made on the rotational spectrum of H_2 in the state I = J = 1 and in strong external magnetic fields. These measurements yield a value for the rotational magnetic moment of H_2 in the rotational state J = 1 of μ_{RH} = 0.88291 ± 0.00007 nuclear magnetons. From this, the high-frequency contribution to the diamagnetic susceptibility is calculated to be $\xi_{HF} = 1.64 \pm 0.16 \times 10^{-31}$ erg gauss^{-2} molecule^{-1}. Since the diamagnetic interaction with the external field increases as the square of the field, the high field measurements yield accurate determinations of the dependence of the diamagnetic susceptibility on the molecules' orientations which is found to be $\xi_{\pm 1} - \xi_0 = -3.66 \pm 0.20 \times 10^{-31}$ erg gauss^{-2} molecule^{-1}. ξ_{HF} and $\xi_{\pm 1} - \xi_0$ may be combined to give a measure of the quadrupole moment of the electron distribution relative to the internuclear axis with the result that $Q_e^{(expt.)} = 0.330 \pm 0.013 \times 10^{-16}$ cm^2. (auth)

312
A DETERMINATION OF $g_J(^2S_{1/2})$ OF POTASSIUM IN TERMS OF THE PROTON GYROMAGNETIC RATIO. Peter Franken and Seymour Koenig. Phys. Rev. 88, 199-202(1952) Oct. 15.

The ratio of the g value of potassium K^{39} in the ground state to the gyromagnetic ratio of the proton in mineral oil has been measured in an experiment combining atomic beam and nuclear resonance techniques. It is found to be $g_J(K)/g_p = 658.2274 \pm 0.0023$. This result, when combined with the measurement of $g_J(H)/g_p$ by Koenig, Prodell, and Kusch (Phys. Rev. 88, 191(1952)) yields $g_J(K)/g_J(H) = 1.000016 \pm 0.0004$ percent. This is to be compared with the recent direct measurement by Pohlman, Bederson, and Eisinger (Phys. Rev. 83, 475(1951)); $g_J(K)/g_J(H) = 1.00016 \pm 0.006$ percent. The present experiment is of superior precision and is in agreement with independent experimental evidence. The present result is found to agree with the theoretically predicted value. (auth)

313
DETERMINATION OF NUCLEAR MOMENTS FROM HERTZIAN SPECTRA. Georges J. Béné. J. phys. radium 13, 473-9(1952) Oct. (In French)

After giving a brief description of the magnetic and electrostatic interactions between the nucleus and an atomic electron, the author reviews the principal methods of microwave spectroscopy permitting measurement of the magnetic and electric quadrupole moments of the nucleus. Direct methods, such as nuclear magnetic resonance, are not discussed. Atomic beams, molecular absorption spectra in the centimeter region, and effects of magnetic fields on these spectra furnish several examples. 16 references. (tr-auth)

314
THE INTERFERENCE OF AMPLITUDES IN CASCADE PROCESSES. O. Halpern and B. A. Lippmann. Phys. Rev. 87, 1128(1952) Sept. 15.

In a two-step cascade emission process, the elimination of the interference terms present certain complications (Halpern, Phys. Rev. 82, 753(1951)) in the case of a polarized initial state. A treatment is suggested for eliminating these complications and for proving that in most general cascade processes a description can always be introduced according to which each step of the cascade leads to one and only one "causal" intermediate state. (L.M.T.)

315
VIBRATIONAL AND CENTRIFUGAL EFFECTS ON NUCLEAR INTERACTIONS AND ROTATIONAL MOMENTS IN MOLECULES. Norman F. Ramsey. Phys. Rev. 87, 1075-9 (1952) Sept. 15.

The effects of zero point vibration and centrifugal stretching of molecules upon the spin-spin magnetic interaction, the spin-rotational magnetic interaction, the molecular rotational magnetic moment, the magnetic shielding of the nucleus, and the molecular diamagnetic susceptibility of the molecule are discussed. Expressions for these quantities with vibrational and centrifugal effects included are given in detail for diatomic molecules and numerical calculations for the cases of H_2 and D_2. It is shown that from measurements of the rotational magnetic moments of both H_2 and D_2 or of H_2 in two different rotational states, one can calculate the variation with internuclear separation of the high frequency terms of the molecular diamagnetic susceptibility. Measurements on the spin-rotational magnetic interactions in both H_2 and D_2 provide information on the variation of this interaction with internuclear spacing and thereby supply important corrections that are needed in calculating the nuclear magnetic shielding from the spin rotational magnetic interaction and in measuring the ratio of the proton magnetic moment to that of the deuteron. These calculations also supply a correction to the spin-spin magnetic interaction that must be used in determining the deuteron quadrupole moment from experiments with D_2. (auth)

316
α-ENERGY SYSTEMATICS AND PROTON SHELLS FOR HEAVIER NUCLEI. S. Sengupta. Phys. Rev. 87, 1136-7 (1952) Sept. 15.

Great regularities are noticed if the α energies for nuclei with the same number of neutrons are plotted against Z. The general trend is an increase of E_α with Z but at certain proton numbers there is a very sudden increase in E_α. Proton subshells at 88 and 92 are indicated. If $B_p(N,Z)$ be the binding energy of the last proton in the nucleus (N,Z), it can be shown that $E_\alpha(N,Z) - E_\alpha(N,Z-1) = B_p(N-2,Z-2) - B_p(N,Z)$. (L.M.T.)

317
MEASUREMENT OF THE NUCLEAR RADII OF SULFUR AND COPPER. M. Ageno, G. Cortellessa, and R. Querzoli. Rend. ist. super. sanità 15, 555-76(1952). (In Italian)

A procedure is described for measuring the total cross sections of elements for neutrons of 13.3 Mev which includes a satisfactory method of correcting the transmission data for scattered slow neutrons. The experimental conditions are such as to reduce to a minimum the correction for nonideal geometry. With this procedure the total cross section of Cu was measured as $3.09 \pm 0.12 \times 10^{-24}$ cm^2, in agreement, within the limits of experimental error, with previous measurement. The total cross section of S, which, according to other authors, differs considerably from that of the average nucleus in its behavior as a function of the mass number, was measured as $2.06 \pm 0.07 \times 10^{-24}$ cm^2, in complete agreement with the average behavior. The conclusions are that the anomalies indicated by others in the total cross section of S are not real and should be credited purely to errors of measurement. The effective nuclear radii of Cu and S are deduced according to the Weisskopf theory. (auth)

318
ISOTOPE SHIFT BETWEEN RaD AND THE STABLE LEAD ISOTOPES. P. Brix, H. v. Buttlar, F. G. Houtermans, and H. Kopfermann. Z. Physik 133, 192-200(1952). (In German)

An isotope shift $\Delta\nu(Pb^{208} - Pb^{210}) = 141 \pm 3 \times 10^{-3}$ cm^{-1} in the Pb I 4058-A line was measured with a Fabry-Perot interferometer. It follows that $\Delta\nu(Pb^{208} - Pb^{210})/\Delta\nu(Pb^{206} - Pb^{208}) = 1.74 \pm 0.05$. Just as at the closed neutron shells at N = 82 and (uncertain) N = 50, an isotope-shift discontinuity exists at N = 126, probably signifying a sudden increase in the nuclear radius. The RaD (Pb^{210}) used was obtained from Rn absorbed in active carbon; chemical separation and the hollow-

cathode spectroscopic procedure are described. For this experiment, 3 μg of RaD sufficed; after eight exposures 73% remained in the cathode. (tr-auth)

319

INTERACTION BETWEEN NUCLEAR SPINS IN HD GAS. H. Y. Carr and E. M. Purcell. Phys. Rev. 88, 415-16(1952) Oct. 15.

The fine structures in H and D resonances observed in HD gas consist of 3 and 2 equally intense lines, respectively, the separations being 43.5 ± 1 cps. The fine structure was observed in the H resonance at 5 and 30 Mc, and was found to be field independent. The observed pattern of the D resonance at 4.4 Mc is a simple beat pattern of two signals, of equal amplitude, corresponding to the two possible orientations of the neighboring H magnetic moment. (L.M.T.)

320

BINDING ENERGIES AND MASSES OF THE NUCLEI A = 17 to A = 32. U. Cappeller. Z. Naturforsch. a7, 574-9(1952) Sept. (In German)

Published data on 77 nuclear reactions involving isotopes of O, F, Ne, Na, Mg, Al, Si, P, and S are collected, together with references. Binding energies and mass defects of the isotopes are calculated from these data. (G.Y.)

321

A THEORETICAL ATTEMPT TO PREDICT THE EXCITED STATES OF NUCLEI IN THE NEIGHBOURHOOD OF ^{208}Pb. M. H. L. Pryce. Proc. Phys. Soc. (London) A65, 773-90 (1952) Oct. 1.

Pb^{208} has a double closed shell of 82 protons and 126 neutrons. The classification of the lowest excited states of Pb^{207}, Tl^{207}, Pb^{209}, Bi^{209}, which differ by one nucleon, should thus follow the single-particle model closely. The attempt is made to classify the lowest excited states of Pb^{206}, Tl^{206}, Hg^{208}, Pb^{210}, Bi^{210}, and Po^{210}, which differ by two particles, in terms of the one-particle model, taking the interaction of the two particles as a perturbation. Considerable uncertainties in the order of the energy levels remain, but some definite conclusions are possible. The existence of an isomeric state of Bi^{210} (RaE) with very high spin (I = 8 ?) is predicted. This fits in with known facts about the α-particle-emitting isomeric state. The method can also be applied to Tl^{208}, Bi^{208}, and the excited states of Pb^{208} which arise by lifting one nucleon into the next shell, leaving a hole. It meets with considerable success for Tl^{208}. Discrepancies with known facts in the case of Pb^{208} suggest a more complex picture, according to which the first excited state would have I = 0 and even parity. Such a state has never been observed, but its existence is not completely excluded by observation. (auth)

322

THE DECAY SERIES $Mn^{51}-Cr^{51}-V^{51}$ AND THE SPIN OF THE Mn ISOTOPE. D. Maeder, P. Preiswerk, and A. Steinemann. Helv. Phys. Acta 25, 461-3(1952) Sept. 15. (In German)

The existence of the 320-kev level in V^{51} (P = 23, N = 28) is explained as resulting from configuration of three protons in the $f_{7/2}$ shell to give a resultant spin of 5/2. The situation is contrasted with that of Mn^{55} (P = 25, N = 30) in which the 5/2 spin is identified with the ground state. (G.Y.)

NUCLEAR REACTORS

323

Argonne National Lab.

HEAT GENERATION IN IRRADIATED URANIUM, by S. Untermyer and J. T. Weills. Feb. 25, 1952. Decl. Oct. 21, 1952. 20p. (AECD-3454; ANL-4790)

Data on the heat generated in irradiated U are presented both as curves and formulas. The data cover the range between 10^{-1} and 10^{8} seconds. Heat is produced in U, after a chain reaction is stopped, from fissions from delay reactions, decay of radioactive fission products, and decay of U^{239} and Np^{239}. Determination of decay heating is made by radiochemical and calorimetric measurements. (J.E.D.)

NUCLEAR TRANSFORMATION

324

Radiation Lab., Univ. of Calif., Berkeley

ACTIVATION ENERGY FOR FISSION, by Glenn T. Seaborg. Aug. 29, 1952. Decl. Nov. 6, 1952. 10p. (AECD-3458; UCRL-1935)

The experimentally determined exponential dependence of spontaneous fission rate on Z^2/A has been used to derive an expression for the dependence of the fission activation energy on Z^2/A. This expression has been used to calculate the activation energy for slow-neutron-induced fission and photofission. The correlation with the experimental data on these types of fission seems to be quite good. (auth)

325

PLURAL THEORIES FOR THE SHOWER COMPONENT IN HIGH ENERGY NUCLEAR DISINTEGRATIONS. H. Messel and R. B. Potts. Phys. Rev. 88, 488-92(1952) Nov. 1.

Detailed numerical results are presented for the average numbers of protons and mesons emitted as shower particles in high-energy nuclear disintegrations. The results for two schemes of plural production of mesons are compared with results previously obtained using the Heitler-Janossy(1) model (Proc. Roy. Phys. Soc. (London) A62, 374(1949)) in which it was assumed that the nucleus is transparent to the mesons emitted in the individual nucleon-nucleon collisions. It is concluded that this latter model best fits the limited experimental data available. The results presented for mesons are based on the assumption that the shower particles consist of π mesons and protons only. This assumption is not essential, as the energy going into the meson component could be considered as producing mesons of various types. Some recent criticisms of the cascade theory are also answered. (auth)

326

(n,2n) REACTIONS IN C^{12}, Cu^{63}, AND Mo^{92}. J. E. Brolley, Jr., J. L. Fowler, and L. K. Schlacks. Phys. Rev. 88, 618-21(1952) Nov. 1.

Using the method of induced radioactivity we have measured the (n,2n) cross sections of C^{12}, Cu^{63}, and Mo^{92} as a function of energy from threshold to 27 Mev. The positron activities of 20, 10, and 15.5 min, respectively, were employed. K-capture corrections were applied to the copper and molybdenum data. We have compared the copper and molybdenum data with the statistical theory of Weisskopf and collaborators (Phys. Rev. 57, 472(1940)) and find satisfactory agreement from threshold to the onset of tertiary reactions. (auth)

327

MAGNETIC ANALYSIS OF THE PROTON GROUPS FROM THE $Na^{23}(d,p)Na^{24}$ REACTION. S. Sperduto and W. W. Buechner. Phys. Rev. 88, 574-9(1952) Nov. 1.

Thin targets of sodium iodide evaporated onto platinum and thin nickel backings have been bombarded with deuterons accelerated to energies ranging from 1.5 to 2.2 Mev by the large M.I.T. air-insulated electrostatic generator. Proton groups emitted at 90° to the incident deuterons were analyzed with a 180° magnetic spectrograph. Twenty of the observed proton groups are assigned to the $Na^{23}(d,p)Na^{24}$, Na^{24*} reaction and correspond with energy levels in Na^{24} up to 4.5 Mev. Several of the groups are closely spaced, and level spacings in Na^{24} as low as 17.0 ± 3 kev have been observed. (auth)

328
NUCLEAR REACTIONS IN THE STARS. I. PROTON-PROTON CHAIN. E. E. Salpeter. Phys. Rev. 88, 547-53 (1952) Nov. 1.

The rates are calculated for the main reactions making up the "proton-proton chain," whose net effect is the conversion of four hydrogen atoms into one helium atom. These calculations are carried out for temperatures and densities corresponding to central conditions in main-sequence stars. The mean reaction rate for the beta-decay conversion of two protons into one deuteron is calculated accurately, using the latest data on the two-nucleon system and on beta decay. It is shown that, under normal stellar conditions, the reaction chain is completed by the radiative capture of a proton by a deuteron and by the collision between two of the resultant He^3 nuclei to form one He^4 nucleus and two protons. Values are given for the rate of energy production and for the concentrations of deuterium and He^3 at various temperatures. (auth)

329
A STUDY OF THE $H^3(d,n)He^4$ REACTION. J. P. Conner, T. W. Bonner, and J. R. Smith. Phys. Rev. 88, 468-76 (1952) Nov. 1.

The nuclear reaction $H^3(d,n)He^4$ has been studied for deuteron energies from 10 up to 1732 kev. The yield curve exhibits a maximum at a deuteron energy of 109 kev, where the total cross section is $5.1 \pm 0.1 \times 10^{-24}$ cm^2. The experimental data accurately fit a single-level Breit-Wigner resonance curve for deuteron energies below 500 kev. Above this energy the experimental cross section is larger than predicted by a single level in the compound He^5 nucleus. (auth)

330
CROSS SECTION AND ANGULAR DISTRIBUTION OF THE $He^3(d,p)He^4$ NUCLEAR REACTION. T. W. Bonner, J. P. Conner, and A. B. Lillie. Phys. Rev. 88, 473-6(1952) Nov. 1.

The cross section for the reaction $He^3(d,p)He^4$ has been studied for deuteron energies from 188 to 1597 kev. The yield of protons at 0° to the deuteron beam exhibits a maximum at 400-kev deuteron energy. At this energy the angular distribution of the disintegration particles is spherically symmetrical and the total cross section is 0.69×10^{-24} cm^2. At higher energies there is a preferential emission of protons at 0°. At 1600 kev the ratio of the number of protons at 0° to that at 90° is 1.08. The variation of total cross section with bombarding energy agrees with a calculated single-level-resonance formula from 188 to 600 kev. At higher energies the theoretical values give too small a cross section. (auth)

331
A SEARCH FOR THE NUCLEAR REACTION $^4He(\alpha,n)^7Be$. D. Walker, W. T. Link, and W. I. B. Smith. Proc. Phys. Soc. (London) A65, 861-2(1952) Oct. 1.

According to the atomic masses the nuclear reaction $He^4(\alpha,n)Be^7$ should be endothermic by 18.98 ± 0.04 Mev, with a threshold energy, in the laboratory system of coordinates, of 38.0 ± 0.1 Mev. An attempt was made to detect this reaction by using 39.9-Mev α particles. Although the reaction was not observed, an upper limit of 7×10^{-28} cm^2, which is about 10^{-3} of the nuclear geometric cross section for the collision of two α particles, was established for its cross section. (G.Y.)

332
PRODUCTION OF PAIRS OF PARTICLES IN COLLISION PROCESSES BETWEEN SPIN-½ PARTICLES. Peter Havas. J. phys. radium 13, 438-40(1952) Oct. (In French)

In a recent paper (see NSA 6-1333), Petiau studied the production of pairs of particles by collision, described as the passage of a Dirac particle E from an unobservable negative energy state to a positive energy state. Only interactions between E and the individual colliding particles were considered. E, as a consequence, passed through an intermediate state. It is established in the present note that the possible existence of an interaction between the colliding particles themselves may give rise to additional intermediate states, whose contribution to the matrix element is of the same order in the coupling constants. The modifications necessary in Petiau's calculations are indicated. (tr-auth)

333
CROSS SECTION FOR THE REACTION $Br^{81}(\gamma,\alpha)As^{77}$. J. G. V. Taylor and R. N. H. Haslam. Phys. Rev. 87, 1138-9(1952) Sept. 15.

The cross section for the (γ,α) reaction in Br^{81} has been found by counting 40-hr As^{77}. Samples of NaBr were irradiated at betatron energies of 16.0 to 25.4 Mev. Arsenic was precipitated from solutions 3N in HCl and obtained for counting as As_2S_3. A cross section peak value of 270 microbarns was found at 21.5 and the integrated cross section is about 1.5 Mev-millibarns. (L.M.T.)

334
THE PHOTONEUTRON CROSS SECTIONS FOR THE REACTIONS $Br^{81}(\gamma,n)Br^{80}$ AND $Br^{81}(\gamma,n)Br^{80*}$ AND AN ANALYSIS OF THE RATIO BETWEEN THESE CROSS SECTIONS. L. Katz, L. Pease, and H. Moody. Can. J. Phys. 30, 476-87 (1952) Sept.

Cross-section curves have been measured as a function of energy for the reactions $Br^{81}(\gamma,n)Br^{80}$ and $Br^{81}(\gamma,n)Br^{80*}$, and the ratio between these cross sections has been examined critically. The curves exhibit the peaked shape characteristic of photonuclear reactions with maximum cross sections of 88 and 42 mb, respectively. It is shown that the ratio of the cross sections depends on the spins of the excited levels in which the Br^{80} nucleus is left prior to γ cascading and thus on the reaction leading to it. An elementary analysis based on this point of view gives results consistent with the ratio measured for six different types of reactions. (auth)

335
ALPHA PARTICLES FROM THE PHOTODISINTEGRATION OF SILVER AND BROMINE. R. N. H. Haslam, A. G. W. Cameron, J. A. Cooke, and E. H. Crosby. Can. J. Phys. 30, 349-69(1952) Sept.

Ilford E1 nuclear emulsions were exposed behind 4 cm of lucite to the x-ray beam of the University of Saskatchewan betatron operating at energies from 12 to 26.6 Mev. They were developed by a "grain-gradation" process in order to suppress proton tracks and γ-ray fog. The variation in yield with energy of the double-peaked single α-particle energy spectrum resulting from the photodisintegration of silver and bromine was studied. Preliminary results are given concerning the cross-section curves corresponding to various portions of this α-particle spectrum. The energy distributions and cross-section curves have been interpreted in terms of the statistical theory of nuclear reactions. (auth)

336
ANGULAR DISTRIBUTION OF BORON GAMMA RADIATION; $B^{11}(p,\gamma)C^{12}$. H. Glättli and P. Stoll. Helv. Phys. Acta 25, 455-8(1952) Sept. 15. (In German)

The angular distributions of the 11.8- and 16.3-Mev γ-ray components of the $B^{11}(p,\gamma)C^{12}$ reaction produced by 150- to 500-kev protons were investigated. The results indicate that the 16.3-Mev excited state of C^{12} has a total angular moment J = 2 and even parity, while the 11.8-Mev level has J = 1 and odd parity. The angular distribution of the α particles from the $B^{11}(p,\alpha)Be^8$ reaction is discussed briefly. (G.Y.)

337
NUCLEAR PHOTOFISSION OF B^{11} AND B^{10}. O. Rochat and P. Stoll. Helv. Phys. Acta 25, 451-4(1952) Sept. 15. (In German)

Preliminary data are reported on statistical studies of the $B^{11}(\gamma,t)2\alpha$, $B^{10}(\gamma,d)2\alpha$, and other reactions evidenced by stars in B-loaded nuclear plates exposed to 14.8- and 17.6-Mev γ rays. Relative cross sections and mechanisms are discussed. (G.Y.)

338
EXCITATION FUNCTION OF THE NUCLEAR REACTION $N^{14}(p,\alpha)C^{11}$. J. P. Blaser, P. Marmier, and M. Sempert. Helv. Phys. Acta 25, 442-4(1952) Sept. 15. (In German)

The excitation curve relating absolute cross sections to energy of the incident proton is presented for the $N^{14}(p,\alpha)C^{11}$ reaction over the energy range 3 to 7 Mev. Four resonance peaks occur at 4.94, 5.3, 5.6, and 6.15 Mev, with respective cross sections of 10, 28, 35, and 66 mb and excitation energies of the intermediate O^{15} nucleus of 11.9, 12.2, 12.5, and 13.0 Mev. Level widths are discussed. (G.Y.)

339
PRODUCTION OF P^{33} WITH THERMAL NEUTRONS. Torbjörn Westermark. Phys. Rev. 88, 573-4(1952) Nov. 1.

A soft beta activity was found in old P^{32} samples from the Harwell reactor. It was established that it definitely is due to a P isotope, probably P^{33}, thus confirming the findings by Jensen (Phys. Rev. 85, 112(1952)) and Sheline (Phys. Rev. 83, 919(1951)). The amount of P^{33} and P^{32} samples from a 14-day irradiation of sulfur has been found to 1.4 ± 0.2 percent. The following data were found: half life 25 ± 2 days, maximum beta energy 246 ± 5 kev, number of gamma rays at most 3.5 percent of the betas, cross section for the presumed $S^{33}(n,p)P^{33}$ reaction 0.03 barn. From energy considerations the latter reaction was found to be exothermic, whereas the reaction leading to P^{32} is endothermic, and this was supported by getting a P activity as rich as 30 percent in P^{33} by means of a purer thermal-neutron flux. The cross section for the $S^{33}(n,p)P^{33}$ reaction for thermal neutrons was found to be 2.3×10^{-3} barn. (auth)

PARTICLE ACCELERATORS

340
Radiation Lab., Univ. of Calif., Berkeley
BIBLIOGRAPHY OF PARTICLE ACCELERATORS [FOR] JANUARY TO DECEMBER 1951, by Sergey Shewchuck. Sept. 1952. 45p. (UCRL-1951)

This bibliography is a supplement to that compiled and edited by E. Thomas, P. Mittelman, and H. H. Goldsmith, issued July 1, 1948 as BNL-L-101, and to the later extension prepared by Bonnie E. Cushman and issued in March, 1951, as UCRL-1238. The journals searched were Chemical Abstracts; Science Abstracts, Section A (Physics) and Section B (Electrical Engineering); Nuclear Science Abstracts; and Nucleonics. The period covered was January, 1951, through December, 1951. News briefs are not included in the list; however, some reports published by various institutions concerning progress in the construction of their particle accelerators are covered. Information pertaining to particle accelerators was obtained primarily from a list of questions sent to institutions throughout the world. (auth)

341
SPECTRUM OF A HIGH-FREQUENCY ION SOURCE. R. Budde and P. Huber. Helv. Phys. Acta 25, 459-61(1952) Sept. 15. (In German)

A h-f discharge ion source is sketched, and the intensity spectrum of the ions evolved when the discharge takes place in H_2 is tabulated. H_1^+, H_2^+, H_3^+, H_4^+, H_3^{++}, and other H ions were present. (G.Y.)

342
A NEW EXTRACTION PRINCIPLE FOR ION SOURCES. APPLICATION TO DIFFERENT TYPES OF SOURCES. J. Sommeria. J. phys. radium 13, 491(1952) Oct. (In French)

In most ion sources the diaphragm is merely an opening in the wall of the ionizing chamber, the ions being extracted, therefore, from only a small portion of the plasma. A "cathode lens" is proposed in which the diaphragm is removed from the wall and the "object" volume is greatly increased. The arrangement has been applied to two ion sources using transverse and longitudinal extraction. (G.Y.)

343
A CONVERTED ELECTRON ACCELERATOR TO PRODUCE 2.3-Mev POSITIVE IONS. R. W. Lamphere and G. P. Robinson. Nucleonics 10, No. 10, 28-31(1952) Oct.

An electrostatic electron accelerator designed and constructed by the High Voltage Laboratory of the Massachusetts Inst. of Tech. and later purchased by Oak Ridge National Lab. has been converted to a positive ion generator and accelerator. Using a r-f ion source, the accelerator produces a 100 μa beam of magnetically analyzed protons up to 2.3 Mev, which can be focused into a spot 1.0 mm in diameter. The beam energy is regulated by a slit-and-corona system to ±3 kev, and, in addition to protons, beams of deuterons, tritons, He^3, and He^4 can be produced. In designing the accelerator tube, compromise had to be made between pumping speed, shielding factor, and minimum spacing between accelerating electrodes as follows: (1) a 3-in. bore with subsequent pumping speed of 100 l/sec, (2) shielding factor of 87%, and (3) a spacing of 0.25 in. between electrodes. (L.M.T.)

RADIATION ABSORPTION AND SCATTERING

344
Oak Ridge National Lab.
THE COHERENT NEUTRON SCATTERING CROSS SECTION OF PHOSPHORUS, by H. A. Levy, S. W. Peterson, and D. E. Lavalle. [nd] 8p. (AECU-2277)

The coherent scattering cross section of P for thermal neutrons has been determined by neutron diffraction analysis of carefully synthesized AlP. A value of 3.14 ± 0.09 barns was obtained, the phase of the scattering being positive. (L.M.T.)

345
Atomic Energy Research Establishment, Harwell, Berks (England)
THE THEORY OF THE DOUBLE COMPTON EFFECT, by F. Mandl and T. H. R. Skyrme. 1952. 17p. (AERE T/R-983)

Using the methods of Feynman, the exact expression is derived for the differential cross section that two photons of given energy are emitted into given directions, as the result of an unpolarized γ ray striking an electron at rest. The probability for this process contains an extra factor e^2/hc compared with ordinary Compton scattering. There is great preference for one soft and one hard photon to be emitted, rather than two photons of approximately equal energy. The hard photon is most likely to be ejected into a narrow cone in the forward direction and, as the bombarding energy increases, this cone becomes narrower. All these results were to be expected. However the soft photon also has a considerable preference for small angle scattering and its angular distribution is not roughly isotropic as one might have expected. (auth)

346
Oak Ridge National Lab.
ENERGY ABSORPTION OF CAPTURE GAMMAS, by H. L. F. Enlund. Oct. 16, 1952. 4p. (CF-52-6-99(suppl.1))

The calculations and γ-energy absorption curves of CF-52-6-99 (NSA 6-4965) are extended to allow prediction of capture-γ heating in any particular material. (H.F.G.)

347

National Bureau of Standards

DEGRADATION AND RANGE STRAGGLING OF HIGH ENERGY RADIATIONS, by U. Fano. Sept. 15, 1952. 82p. (NBS-1919)

The energy-degradation problem and the two-variable problem of range-energy straggling of high-energy ionizing radiations are first surveyed on the basis of ideas developed for the neutron (Marshak, Revs. Modern Phys., 19, 185 (1947)), but aim is directed toward electron problem application. Important regularities in the energy degradation process are shown to arise when successive energy losses obey nearly equal statistical laws, this occurring when the cross section changes little between collisions. An analytical method of successive approximations is then developed which applies to heavy charged particles and serves in calculation of corrections to earlier elementary theories. In the two-variable range-energy straggling problem, general treatment is given to the energy distribution of particles which have traveled a certain path length from their source and of the path-length distribution of particles degraded to a certain energy. The treatment relies heavily on the concepts and techniques of the energy-degradation problem, primarily applicable to heavy charged particles, but it is hoped that the methods will also be useful for analyzing electron straggling. (L.M.T.)

348

National Bureau of Standards

CALCULATION OF PEAKED ANGULAR DISTRIBUTIONS FROM LEGENDRE POLYNOMIAL EXPANSIONS AND AN APPLICATION TO THE MULTIPLE SCATTERING OF CHARGED PARTICLES, by L. V. Spencer. Sept. 25, 1952. 19p. (NBS-1955)

A method for evaluating Fourier integrals is presented which relies upon qualitative information about the integral and which combines some of the advantages of both numerical and analytic techniques. A formula is then derived which sums a slowly convergent series of Legendre polynomials by making use of a Fourier integral "small angle" approximation. The combination of the two techniques is then used to sum the slowly convergent Legendre polynomial series which then represents the directional distribution of multiply scattered charged particles. Comparisons with "small angle" calculations by Molière (Z. Naturforsch. a3, 78(1948)) and Snyder and Scott (Phys. Rev. 76, 220(1949)) are included. (auth)

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Rochester Univ.

THE S WAVE IN PION-NUCLEON SCATTERING, by R. E. Marshak. Oct. 4, 1952. 5p. (NYO-3705)

It has been shown by other investigators that in the angular distribution of π^+ and π^- mesons scattered by protons the S-phase shifts exhibit a more rapid decrease than the P-phase shifts, a feature which is contrary to expectation for monotonic potential. Moreover, there is an indication that the S phase will vanish somewhere in the energy range 30 to 50 Mev. It has, however, been shown that the S-phase shift cannot stay close to zero at lower energies. This report points out that the observations can be explained by postulating that at least in the S state an effective attractive potential with a repulsive core exists between the two members of the pion-nucleon system. (L.T.W.)

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Radiation Lab., Univ. of Calif., Berkeley

HIGH ENERGY PHOTOPROTON PRODUCTION BY 322 MEV BREMSSTRAHLUNG, by J. W. Rosengren and J. M. Dudley. Oct. 13, 1952. 16p. (UCRL-1913(rev.))

The ejection of high-energy protons from various materials by 322-Mev bremsstrahlung has been investigated using a detector telescope consisting of three liquid scintillators. Protons, above a minimum energy of 65 Mev, were distinguished from other particles by their dE/dx at a fixed range. At 70 Mev the angular distribution appears to be independent of nuclear complexity; the relative distributions from Li, C, and Ta have about the same shape. Distributions from C at 77, 127, and 174 Mev were measured between 11 and 45°. The data do not fit the predictions of a quasi-deuteron model, but adequate calculations require more knowledge of the deuteron photodissociation process. The yields at 45° for 72 and 142 Mev protons from various materials was found to be directly proportional to Z. The energy spectra of photoprotons from C have been measured at 45 and 90°. The absolute differential cross section for production of 72 Mev protons from C at 90° has been measured. (auth)

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Radiation Lab., Univ. of Calif., Berkeley

ELECTRON-POSITRON ANNIHILATION IN FLIGHT, by S. A. Colgate and F. C. Gilbert. Oct. 7, 1952. 12p. (UCRL-1960)

The positron-electron annihilation cross section has been measured for 50, 100, and 200 Mev incident positron energies. Three small proportional counters in a magnetic field determined the incident electron or positron momentum and a large scintillation counter immediately behind the absorber indicated the disappearance of a particle. The positron annihilation cross section was determined by subtracting the electron loss rate (due mainly to bremsstrahlung energy losses) from the positron loss rate. The cross sections obtained at 50, 100 and 200 Mev were, respectively, 11.0 ± 2.5, 6.3 ± 1.2, and $3\text{-}7 \pm 0.6$ millibarns per electron in a beryllium absorber, in good agreement with Dirac's two-quantum annihilation cross section. The presence of annihilation radiation was detected in coincidence with the disappearance of a positron within a small cone in the forward direction. (auth)

352

ABSORPTION OF 5.3-MEV, 10.3-MEV, AND 17.6-MEV GAMMA-RAYS. E. S. Rosenblum, E. F. Shrader, and R. M. Warner, Jr. Phys. Rev. 88, 612-17(1952) Nov. 1.

Gamma-ray absorption cross sections have been measured for Cu, Sn, Pb, and U at each of the gamma-ray energies, 5.3, 10.3, and 17.6 Mev. Betatron radiation collimated to give "good" geometry is used for the transmission measurements. The energy-sensitive detector used is a 180° homogeneous magnetic-field pair spectrometer with crystal and photomultiplier detectors. The measured cross sections in units of barns per atom are, at 5.3 Mev, 3.244 (Cu), 7.05 (Sn), 15.07 (Pb), and 18.43 (U); at 10.3 Mev, 3.285 (Cu), 7.95 (Sn), 17.83 (Pb), and 21.73 (U); and at 17.6 Mev, 3.688 (Cu), 9.22 (Sn), 20.47 (Pb), and 25.32 (U). The statistical errors range from 0.5 percent to 1.5 percent. The pair cross sections are inferred by subtracting the best-known values of the cross sections for the Compton, nuclear, and photoelectric effects from the total cross section. The ratio of this pair cross section to the value calculated from the Bethe-Heitler theory (Proc. Roy. Soc. (London) 146, 83(1934)) is given as a function of energy. The present results give the transition of this ratio which is greater than unity for low energy gamma rays to a value less than unity at extremely high gamma-ray energies. (auth)

353

ENERGY DISTRIBUTION OF SLOW NEUTRONS SCAT-

TERED FROM SOLIDS. B. N. Brockhouse and D. G. Hurst. Phys. Rev. 88, 542-7(1952) Nov. 1.

The sharp dependence on energy of the cadmium cross section for neutrons of energies near 0.35 ev has been used to investigate the energy distribution of 0.35-ev neutrons scattered through 90° by lead, aluminum, diamond, and graphite. The transmission of the scattered neutrons by cadmium filters was measured as a function of cadmium thickness and compared with cadmium transmissions calculated for an Einstein crystal model. In all cases agreement was obtained. For lead and aluminum at room temperature the simpler model of a gas of free atoms gave equally good agreement, a well-known behavior at high energies, but here applying when the temperature and neutron energy were only moderately greater than the Einstein temperature and much less than the binding energy. Theoretical formulas for the partial differential-scattering cross sections for the two models are given in convenient form. (auth)

354

THE SCATTERING OF FAST ELECTRONS AND POSITRONS IN HEAVY ELEMENTS. E. M Gunnersen. Australian J. Sci. Research 5, 258-65(1952) June.

The angular distribution for the single elastic scattering of 1.07 Mev positrons and electrons by the Hartree field of mercury (Z = 80) is calculated. The results show no large deviations from coulomb values except, possibly, a slight increase in the region of 90° for electrons. (auth)

355

THE ABSORPTION OF HIGH ENERGY X-RAYS IN VARIOUS MATERIALS. H. Janzen. Phys. Rev. 88, 653-4(1952) Nov. 1.

Effective absorption cross sections for the x rays exciting the well-known $Cu^{63}(\gamma,n)Cu^{62}$ reaction have been measured in a number of elements. In agreement with other workers, the experimental cross sections have been found to be lower than those predicted by theory by a fraction roughly proportional to Z^2, which amounts to about 10 percent for Pb. By using the results of these measurements as a standard, the effective energies, with Pb absorbers, of the x rays exciting the $C^{12}(\gamma,n)C^{11}$, $Mo^{92}(\gamma,n)Mo^{91}$, and $Ag^{107}(\gamma,n)Ag^{106}$ reactions have been found to be 26.0 ± 1.4, 17.0 ± 1.0, and 16.1 ± 0.9 Mev, respectively, in good agreement with resonance peak energies obtained by more elaborate methods. (auth)

356

A VARIATIONAL PRINCIPLE FOR SCATTERING. Herman Feshbach and S. I. Rubinow. Phys. Rev. 88, 484-7(1952) Nov. 1.

A variational principle is presented for the phase shifts δ_l of a central force scattering problem. This generalizes the principles of Schwinger and Hulthèn for S-state scattering in that (a) it is applicable to states of higher angular momentum, and (b) it depends explicitly on the "inside" wave function only. The Born approximation may be obtained with the choice of an appropriate trial function. Illustrative calculations have been made for the S- and P-state scattering states for an exponential-well nucleon-nucleon interaction potential. A simple one-parameter trial function was utilized. The results are in excellent agreement with previously given exact calculations. (auth)

357

ELASTIC SCATTERING OF 10-MEV DEUTERONS BY H^3 AND He^3. J. C. Allred, A. H. Armstrong, A. M. Hudson, R. M. Potter, E. S. Robinson, Louis Rosen, and E. J. Stovall, Jr. Phys. Rev. 88, 425-30(1952) Nov. 1.

The d-t and d-He^3 differential-elastic-scattering cross sections have been measured for the 10-Mev deuteron-bombarding energy of the external beam of the Los Alamos cyclotron. Nuclear plates detected the charged particles in the angular region 30 to 140° in the c.m. coordinate system. Although the cross section as a function of angle shows marked asymmetries, indicative of scattering contributions from partial waves of high angular momentum, the two curves are identical above 45° in the c.m. system. (auth)

358

THE SCATTERING OF SLOW NEUTRONS IN POLYCRYSTALLINE MEDIA. Ronald W. Gurney. Phys. Rev. 88, 466-7(1952) Nov. 1.

When a neutron passing through a crystallite has insufficient energy to eject an atom from its site, excitation of a lattice vibration occurs instead. This paper deals mainly with neutrons having energy between 0.5 and 5.0 e.v., the range where both the cross section for elastic scattering σ_{el}, and that for inelastic scattering σ_{in} vary rapidly with energy. In order to deal with inelastic collisions in which many phonons are exchanged, Finkelstein, (Phys. Rev. 72, 907(1947)) replaced the Debye model of the crystal by the Einstein model and gave expressions for $J_n(E)$, the probability that a neutron having energy E colliding with an atom of mass M loses at a collision n quanta. Computations of J_n for large and small M show in detail that in the slowing-down process by this mechanism a heavy element is much less efficient than a light element, as in the familiar case of fast neutrons. Since in this range of energy σ_{el} is inversely proportional to E, and since the observed total cross section is independent of energy, this implies that σ_{in} is of the form $\sigma_{in} = \sigma_0(1 - A/E)$. Computed values of ΣJ_n are found to lead to this form, irrespective of the particular Einstein temperature assumed for the solid. (auth)

359

ANGULAR CORRELATIONS OF THE RADIATIONS FROM DEUTERON STRIPPING REACTIONS. L. C. Biedenharn, Keith Boyer, and R. A. Charpie. Phys. Rev. 88, 517-19 (1952) Nov. 1.

The general problem of the angular correlation of the radiations from excited states of nuclei produced in stripping reactions is discussed using the theory of Butler (Proc. Roy. Soc. (London) A208, 259(1951)). The $(d,p\gamma)$ correlation is given explicitly. (auth)

360

THE UNIVERSITY OF PITTSBURGH SCATTERING PROJECT. R. S. Bender, E. M. Reilley, A. J. Allen, R. Ely, J. S. Arthur, and H. J. Hausman. Rev. Sci. Instruments 23, 542-47(1952) Oct.

A scattering program at the University of Pittsburgh uses charged particles from the cyclotron (8-Mev protons, 16-Mev deuterons, and 32-Mev alpha particles). An electromagnet focuses the cyclotron beam through an aperture in an 8-ft shielding wall into a scattering laboratory; a second magnet analyzes the beam in energy; a third magnet analyzes the energy of the charged particles produced in the reaction. For ⅛ in. analyzing slits 1.0 microamperes of 8 ± 0.010-Mev protons are available at the target 31 ft distant from the cyclotron. The reaction particle analyzer can be rotated about the target. The energy dispersion for 5.298-Mev alpha-particles is 0.192 Mev/in. for each analyzer; the momentum resolution is 1 part in 850. The detector is a scintillation counter. The energy determinations at present stage of development are thought to be accurate to ±0.2 percent ascribed to magnet calibration uncertainties. Energies above and below this value are thought to be of the same precision but the actual calibrations have not been completed. (auth)

361

DIFFUSE REFLECTION OF NEUTRONS FROM A SINGLE CRYSTAL. R. D. Lowde. Proc. Phys. Soc. (London) A65, 857-8(1952) Oct. 1.

Diffuse streaks, arising from vibrational and magnetic inelastic scattering processes, have been observed in the Laue

diffraction pattern of an Fe single crystal in a neutron beam from the Harwell pile. The (110) diffuse streak is illustrated. The intensity of the extra scattering is, as with x rays, a few thousandths that of the elastic reflection. Between 292 and 585°K it is closely proportional to temperature. Correspondence of the experimental findings with theory is discussed. (G.Y.)

362

NEUTRON CAPTURE CROSS SECTIONS. B. Margolis. Phys. Rev. 88, 327-31(1952) Oct. 15.

Cross-section formulas for neutron capture are developed by means of statistical theory, for intermediate and heavy-weight nuclei for energies of the order of 1 kev to a few Mev. The formulas do not exhibit resonances, but are rather averages over resonances in the energy region where these exist. The case is treated where the residual nucleus levels are well separated, although the method is applicable in principle where these levels form a virtual continuum. The processes competing with capture in the energy range considered are elastic and inelastic scattering. The energy dependence of radiation widths is estimated. The ratio of energy-level spacing to radiation width at the dissociation energy of a neutron enters as a parameter in the cross-section formulas. This ratio is chosen to make experiment and theory agree as well as possible. Taking the spacing of levels of a given spin and parity at the dissociation energy of a neutron to be 25 ev, the values of the radiation widths are found to be 0.08 ev for Ag^{108} and In^{116}, 0.10 ev for Ag^{110}, and 0.20 ev for Au^{198}. (auth)

363

THE COULOMB SCATTERING OF RELATIVISTIC ELECTRONS AND POSITRONS BY NUCLEI. Herman Feshbach. Phys. Rev. 88, 295-7(1952) Oct. 15.

The Mott series (Proc. Roy. Soc. (London) A124, 426(1929); A135, 429(1932)) for the coulomb scattering of electrons and positrons of high energy is summed numerically for angles varying from 30 to 150° and for nuclear charge varying from 13 to 80. (auth)

364

THE RANGE OF ALPHA-PARTICLES IN WATER. Hervasio G. De Carvalho and Herman Yagoda. Phys. Rev. 88, 273-8 (1952) Oct. 15.

A photographic method is described for measuring the ranges of alpha particles in liquids whose properties are compatible with emulsion sensitivity, utilizing a surface deposit of radiocolloid aggregates as point sources of alpha radiation. The method has been applied to both water of normal isotopic composition and to heavy water containing 97 percent deuterium oxide. Using polonium radiocolloids as a source of 5.3-Mev alpha particles, ranges of 38.1 ± 0.5 and 38.0 ± 0.5 microns were measured in the respective liquids. By conducting the exposure at temperatures below the freezing point the method is also applicable to certain solid media. The ranges of RaF alpha particles in normal and heavy ice were found to be 41.6 ± 0.5 and 41.5 ± 0.5 microns. The integral molecular stopping power of water is computed to be 1.56 ± 0.02 for an alpha-particle energy of 5.3 Mev. Similar measurements with radium sulfate radiocolloids indicates a molecular stopping power of 1.56 ± 0.02 for the alpha particles from RaC', as compared with a computed value of 1.54 ± 0.02. Larger estimates for this constant may originate from water-air interface effects inherent in experiments with an external detector. (auth)

365

THE ANGULAR DISTRIBUTION OF ALPHA-PARTICLES FROM THE REACTION OF DEUTERONS WITH TRITONS. T. F. Stratton and George D. Freier. Phys. Rev. 88, 261-3 (1952) Oct. 15.

The distribution, as a function of angle, of the α particles produced in the reaction of deuterons on tritons has been measured using a monoergic beam of deuterons from the Minnesota electrostatic generator. The α particles were detected in the angular range of 40 to 140° in the c.m. system of coordinates for an incident deuteron energy of 2.21 Mev (lab.). The c.m. differential reaction cross section was flat at 8 millibarns from 40 to 90° and rose to about 13 millibarns at 140°. (auth)

366

MULTIPLE SCATTERING IN NEUTRONS. III. SCATTERING BY SPIN-DEPENDENT FORCES AND POLARIZATION PHENOMENA. Otto Halpern. Phys. Rev. 88, 232-5(1952) Oct. 15.

The treatment presented in two preceding papers (see NSA 4-1202) is extended to cover the case of spin-dependent forces. A general theorem is derived which reduces the problem of scattering by spin-dependent forces to the problem of scattering by spin-independent forces, which has previously been solved analytically. It is shown that observations on the neutrons returning from the scatterer can be used in many practical cases to determine the ratio of the two scattering amplitudes. Similarly, for very small probability of depolarization per single collision, the depolarization of the neutrons transmitted through the scatterer offers information about the spin dependence of the scattering amplitudes. The necessary material for the evaluation of the observation is presented in table form. A comparison is made with a paper by Borowitz and Hamermesh (Phys. Rev. 74, 1285(1948)) in which the same subject has been treated by a different method. (auth)

367

THE ELASTIC SCATTERING OF DEUTERONS BY TRITONS. W. R. Stratton, G. D. Freier, G. R. Keepin, D. Rankin, and T. F. Stratton. Phys. Rev. 88, 257-61(1952) Oct. 15.

The differential cross section for the elastic scattering of deuterons by tritons has been measured in the energy range 0.96 to 3.22 Mev. The angular range of data is between 44.3 and 126.4° in the c.m. system of coordinates. The values of the cross section have a minimum near 90°, and this minimum decreases steadily and moves to higher angles as the incident deuteron energy is increased. At 1.20 Mev the cross section at the minimum is equal to 0.130 barn, and at 3.22 it is 0.019 barn. (auth)

368

DIFFERENTIAL CROSS-SECTION MEASUREMENTS FOR THE SCATTERING OF PROTONS BY DEUTERONS. R. J. S. Brown, George D. Freier, H. D. Holmgren, W. R. Stratton, and J. L. Yarnell. Phys. Rev. 88, 253-6(1952) Oct. 15.

The differential cross section for protons elastically scattered by an incident deuteron beam has been measured in the energy range 0.96 to 3.22 Mev. This corresponds to an extension of previous p-d scattering data down to an energy of 0.48 Mev incident proton energy. The angular range in the c.m. system of coordinates is from 67 to 126° with the cross section showing characteristic minima in the neighborhood of 90° at each energy considered. Values of the cross section vary from 0.147 to 0.280 barns over this range of parameters. (auth)

369

BREMSSTRAHLUNG RADIATION OF ELECTRON ON ELECTRON IN THE NONRELATIVISTIC CASE. B. K. Fedyushin. Zhur. Eksptl'. i Teoret. Fiz. 22, 140-2(1952) Feb. (In Russian)

The bremsstrahlung of electron on electron is considered in the nonrelativistic case taking exchange into account, and the mean energy losses of electron in matter due to bremsstrahlung on electrons are evaluated. (G.Y.)

370
THE ANGULAR DISTRIBUTION OF FISSION FRAGMENTS IN THE PHOTOFISSION OF THORIUM. W. J. Winhold, P. T. Demos, and I. Halpern. Phys. Rev. 87, 1139-40(1952) Sept. 15.

Measurements of the angular distribution of photofission fragments from Th have been made using the x-ray beam of the MIT linear accelerator. They were performed by counting the β activities of the fragments which were emitted from a Th foil and caught at various angles to the x-ray beam. The observed angular distribution has a maximum at right angles to the beam and the amount of the anisotropy decreases with increasing photon energy. (auth)

371
THE DOUBLE COMPTON EFFECT. Patrick E. Cavanagh. Phys. Rev. 87, 1131(1952) Sept. 15.

In this study of the double Compton effect, two NaI(Tl) crystals, shielded from each other and placed in a plane just below and perpendicular to a foil receiving γ rays from a 200-mc source, detected quanta with scattering angles between 45 and 145°. Be, Al, Cu, and Ag scatterers with thickness varying from 40 to 400 mg/cm^2 were used. In each case below ~200 mg/cm^2 the variation of coincidence rate per recorded quantum with thickness can be represented by the sum of a constant term and a term varying linearly with thickness, the magnitude of the constant term being independent of Z. The determined double Compton cross section in the energy range 80 to 530 kev is about 3×10^{-3} of the single Compton cross section. (L.M.T.)

372
CALCULATION OF RANGE-ENERGY RELATIONS FOR ALPHA-PARTICLES IN PHOTOGRAPHIC EMULSIONS. M. Bogaardt and B. Koudijs. Phys. Rev. 87, 1129-30(1952) Sept. 15.

The total rate of energy loss of α particles traversing a dry Ilford C2 emulsion has been computed with regard to the chemical elements present in the plates by using the Bethe formula as an empirical formula. A correction term allows heavier elements, at low energies of the incident particles, to be treated. Range-energy relations thus obtained are in good agreement with experimental results. (L.M.T.)

373
SEARCH FOR ANOMALOUS ABSORPTION OF Ra(B + C) γ RAYS. W. R. Dixon and G. N. Whyte. Can. J. Phys. 30, 438-41(1952) Sept.

The absorption of Ra(B + C) (Pb^{214} + Bi^{214}) γ rays in Pb from 13 to 26 cm has been investigated in a search for the anomalies reported by Sen Chaudhary (Indian J. Phys. 22, 106, 341(1948)). No such anomalies were found. (auth)

374
DIRECT MEASUREMENT OF ANGULAR DISTRIBUTION OF NEUTRONS SCATTERED ON C^{12}. A. E. Remund and R. Ricamo. Helv. Phys. Acta 25, 447-50(1952) Sept. 15. (In German)

An experimental method for direct measurement of the angular distribution of scattered neutrons has been tested. Monochromatic neutrons from the D(d,n)He^3 reaction were scattered from a graphite ring on the symmetry axis of which was mounted both source and detector as well as an intervening paraffin block. Angular distribution measurements are compared with those made with a graphite cylinder. Evidence that the 8.20-Mev level of C^{13} is a $d_{\frac{3}{2}}$ state is concluded. (G.Y.)

375
SCATTERING OF FAST NEUTRONS ON He^4 AND C^{12}. P. Huber, E. Baldinger, and R. Budde. Helv. Phys. Acta 25, 444-6(1952) Sept. 15. (In German)

Histograms of the differential cross sections for neutron scattering on C^{12} are presented for neutron energies from 2.6 to 4.15 Mev. Phase analysis indicates two resonance levels, a $d_{\frac{3}{2}}$ at 2.95 and an $s_{\frac{1}{2}}$ at 3.04 Mev. Results on He^4 have been published elsewhere (NSA 6-5490). (G.Y.)

376
THE BACKSCATTERING OF POSITRONS AND ELECTRONS. H. H. Seliger. Phys. Rev. 88, 408-12(1952)

Beta rays from a point source, backscattered by materials of various atomic numbers Z have been collected over a 2π solid angle and also over narrow solid angles at various obliquities. In all cases electrons are backscattered to a greater extent than positrons. The number and energy spectrum of the backscattered beta rays depend strongly on the direction of emergence and on Z. In spite of the use of heteroenergetic sources, the results can be interpreted qualitatively on the basis of multiple scattering, in terms of a "sidescattered" and a "diffused" component. (auth)

377
STRONG COUPLING IN INELASTIC COLLISIONS OF ELECTRONS WITH ATOMS. H. S. W. Massey and C. B. O. Mohr. Proc. Phys. Soc. (London) A65, 845-53(1952) Oct. 1.

The various approximations which have been used to calculate the probability of excitation of an atom by impact with an electron whose energy is not greatly in excess of the threshold are known to fail under certain conditions. This is especially true in the important cases in which the excitation proceeds mainly through electron exchange. In these cases the exchange coupling is too strong for approximate methods, which assume weak coupling, to be valid. By using a schematic model, exact solutions for strong exchange coupling are obtained and compared with the results of different weak coupling approximations. It is found that the Born-Oppenheimer approximation is never reliable at low electron energies, but if distortion of the incident and scattered waves by the atomic field is allowed for correctly much better results may be obtained. (auth)

378
ABSOLUTE VALUE OF THE WORK PER ION PAIR FOR POLONIUM α PARTICLES IN THE GASES He, N_2, A, O_2, AND CO_2. W. Haeberli, P. Huber, and E. Baldinger. Helv. Phys. Acta 25, 467-8(1952) Sept. 15. (In German)

The following values, essentially pressure independent, of the work per ion pair for Po α particles were determined experimentally with an ionization chamber: He (96% purity), 30.86; A (99.7%), 26.25; N_2 (99.9%), 36.30; O_2 (98.5%), 32.17; and CO_2 (99.8%), 33.5 ev. The error is ~2% for CO_2, <0.5% for the other gases. (G.Y.)

RADIATION EFFECTS

379
ENERGY PER ION PAIR FOR ARGON WITH SMALL ADMIXTURE OF OTHER GASES. J. Sharpe. Proc. Phys. Soc. (London) A65, 859-60(1952) Oct. 1.

The average energy $\underline{w}$ required to form one ion pair was measured in various gases by observing the ionization current produced by the complete absorption of α particles of known energy. The ionization current in A was increased by about 1% (corresponding to a decrease in $\underline{w}$) by the admixture of 2 to 5% of CO_2 or O_2. This is attributed to destruction of excited states by the contaminant. The following absolute values of $\underline{w}$, to within 1%, were obtained with Pu α particles: A, 26.3; air, 35.6; O_2, 32.9; N_2, 36.4; CH_4, 29.1; CO_2, 34.2; A + 5% CO_2, 26.1. (G.Y.)

380
INTENSITY LIMITATIONS IN A POINT SOURCE OF X-RAYS. V. E. Cosslett. Proc. Phys. Soc. (London) B65, 782-5(1952) Oct. 1.

When the diameter of the focal spot of electrons on an x-ray target is reduced to the order of a micron, the conditions of heat dissipation become so favorable that a greatly in-

creased specific loading is possible. The use of an electron lens to obtain such a small spot introduces a limitation on the rate of supply of energy, as its high spherical aberration requires insertion of a very small aperture, the size of which must be reduced pari passu with the size of spot desired. For magnetic lenses of usual design the rate of energy supply is then proportional to the radius of the spot. Comparison with the rate of heat dissipation shows that, for spots of the order of a micron, the limitation on x-ray intensity is not the thermal properties of the target, as in tubes with large focus, but the emission obtainable from the cathode. Specific loadings of the order of 10^7 watts/cm^2 can be tolerated in a spot of 1 μ; the corresponding emission current density would be of the order of 100 amp/cm^2. (auth)

381

LIGHT YIELD AND DISSOCIATION OF PHOSPHORS BY ELECTRON AND ION COLLISIONS. W. Hanle and K. H. Rau. Z. Physik 133, 297-308(1952). (In German).

The photo-yields of ZnS – 10^{-3}% Ag, Zn_2SiO_4 – 0.5% Mn, and $MgWO_4$ were measured during excitation by H_2, He, Ne, A, and Xe canal rays. Dependence of the photo-yield (emitted light energy divided by incident particle energy) on energy of the ion was found to be very small. It was independent of ion density, and decreased sharply with increasing ion mass. Dissociation of the phosphors increased with increasing ion mass and was dependent on the ion density. This behavior is compared to the dissociation of organic phosphors (anthracene) by electrons. (G.Y.)

382

SPECULATION ON THE FORMATION OF F-CENTERS DURING IRRADIATION. Jordan J. Markham. Phys. Rev. 88, 500-9(1952) Nov. 1.

It is suggested in this paper that x-ray and radium radiation cause three effects on alkali-halide crystals, namely, to produce free electrons, free holes, and single-ion vacancies. It is further assumed that the single-ion vacancy results from a local distortion of the lattice rather than a diffusion of vacancy pairs from outside the crystal. This postulate explains qualitatively various color-center phenomena observed at low temperatures and leads to no obvious contradictions. Some rough calculations on this model have been made. Further experimental verification is required. (auth)

383

LETHAL EFFECTS ON MICE OF IRRADIATION IN THE ZOE PILE. Paul Bonét-Maury and André Ertaud. Compt. rend. 235, 828-30(1952) Oct. 13. (In French)

The mean survival curve of mice exposed in Al cages in the interior of the Châtillon pile was determined using 400 18- to 20-g animals in lots of 10. The curve is contrasted with that for x and γ rays, and the relative behavior of the mice exposed to the different radiations is described. The marked decrease in survival time when the animals were irradiated in Cd cages is noted. (G.Y.)

384

COLOR CENTERS IN DIAMONDS. Peter Pringsheim and Ruth Casler Voreck. Z. Physik 133, 2-8(1952). (In German)

Absorption spectra are presented of both types I and II diamonds irradiated with fast neutrons, then heated at various temperatures between 350 and 780°C. In some cases several irradiations and annealings were interspersed. Fine structure of significance to understanding of the neutron-induced color centers in diamonds is discussed. (G.Y.)

RADIOACTIVITY

385

Los Alamos Scientific Lab.

THE DECAY OF Zn^{69}, by R. B. Duffield and L. M. Langer. [nd] 8p. (AECU-2284; LADC-1292)

The 52-minute ground state of Zn^{69} has been found to decay with a simple beta spectrum of end point 0.897 ± 0.005 Mev. The 13.8-hour isomer of Zn^{69} decays to the ground state by emission of a gamma ray of energy 0.436 ± 0.004 Mev. The conversion coefficient of this gamma ray is 0.06 indicating an M4 transition. (auth)

386

Rochester Univ.

THE LONG-WAVELENGTH APPROXIMATION IN MULTIPOLE RADIATION, by J. B. French and Y. Shimamoto. Oct. 9, 1952. 4p. (NYO-3706)

In the long-wavelength approximation the electric multipole moments are expressed in terms of the transition-charge density which is determined by the longitudinal current. All radiation should depend on the transverse current. This fact suggests that there exists a connection between the longitudinal and transverse currents. The nature of this connection is examined theoretically. (L.T.W.)

387

Johns Hopkins Univ.

ANNUAL REPORT ON STUDIES OF NUCLEAR GAMMA RAYS, by L. Madansky and F. Rasetti. Sept. 1, 1952. 38p. (NYO-3901)

Separate abstracts have been prepared on the four sections of this report.

388

Johns Hopkins Univ.

A NOTE ON THE ALPHA-GAMMA ANGULAR CORRELATION IN RADIOTHORIUM, by James Battey, L. Madansky, and F. Rasetti, p.3-12 of ANNUAL REPORT ON STUDIES OF NUCLEAR GAMMA RAYS, by L. Madansky and F. Rasetti. Sept. 1, 1952. 12p. (NYO-3901(p.3-12))

The α decay of radiothorium is followed by an 83.3-kev γ ray whose angular correlation with the α particle was investigated, using scintillation counters and fast coincidence circuits. The correlation curve does not agree with any of the theoretical ones derived under the assumption that the angular momenta of the three states involved are O-J-O. Possible reasons for this somewhat unexpected result are discussed. (auth)

389

Johns Hopkins Univ.

POLARIZATION CORRELATIONS OF THE GAMMA RAYS OF Cs^{134} AND OF ANNIHILATION RADIATION, by Berol L. Robinson and Leon Madansky, p.13-24 of ANNUAL REPORT ON STUDIES OF NUCLEAR GAMMA RAYS, by L. Madansky and F. Rasetti. Sept. 1, 1952. 17p. (NYO-3901(p.13-24))

The polarization correlation of the antiparallel cascade γ rays of Cs^{134} has been observed. The well known cross-polarization property of the annihilation radiation has been utilized to determine the effective geometry of the polarimeters. The observed ratio of coincidences in perpendicular and parallel orientations is 0.91 ± 0.08. This ratio is not in disagreement with previous assignments of spins and parities to the excited states of the daughter nucleus, Ba^{134}. (auth)

390

Johns Hopkins Univ.

ON THE CONTINUOUS GAMMA RAY SPECTRUM ACCOMPANYING BETA DECAY, by P. Bolgiano, L. Madansky, and F. Rasetti, p.25-36 of ANNUAL REPORT ON STUDIES OF NUCLEAR GAMMA RAYS, by L. Madansky and F. Rasetti. Sept. 1, 1952. 19p. (NYO-3901(p.25-36))

The spectral distribution and absolute intensity of the internal bremsstrahlung emitted in β decay was investigated in P^{32}, Y^{91}, and RaE. The gamma radiation was detected by means of a NaI (Tl) crystal, phototube, linear amplifier and one-channel discriminator. Care was taken to avoid spurious effects, and corrections were made for

several factors. Both the spectral distributions and the absolute intensities of the continua are in excellent agreement with theoretical predictions. The differences in the spectra due to allowed or forbidden types of the beta transition and to different forms of interaction are too small to be detected in these experiments. Observations on the angular correlation of the internal bremsstrahlung of β emitters and on the internal bremsstrahlung emitted in K capture are also reported. (auth)

391

INTERNAL PAIR CONVERSION IN Mg^{24}. Stewart D. Bloom. Phys. Rev. 88, 312-21(1952) Oct. 15.

The positron spectra from the internal pair conversion of the two γ rays following the β^- decay of Na^{24} have been observed, and the internal pair conversion coefficients found to be 7.1×10^{-4} in the case of the 2.758-Mev γ ray and 0.6×10^{-4} in the case of the 1.380-Mev γ ray. The value of the coefficients and the shape of the spectra lead to the conclusion that both γ rays are electric quadrupole transitions. (auth)

392

INVESTIGATION OF THE CONVERSION ELECTRONS OF Pa^{231}. Paul Falk-Vairant. Compt. rend. 235, 796-9(1952) Oct. 13. (In French)

Conversion electrons accompanying the transformation $Pa^{231} \rightarrow Ac^{227}$ were studied with a semicircular permanent-magnet spectrograph over the energy range 10 to 400 kev. Energies, relative intensities, and responsible γ rays are tabulated for 35 conversion lines. (G.Y.)

393

GAMMA-RAYS FROM Sn^{125}. C. E. Mandeville, E. Shapiro, R. I. Mendenhall, E. R. Zucker, and G. L. Conklin. Phys. Rev. 88, 554-5(1952) Nov. 1.

An inner beta spectrum at ~0.5 Mev, coincident with gamma radiation, constitutes 10 ± 2 percent of the total beta radiation of the 10-day Sn^{125}. The gamma rays have a maximum energy of 1.67 ± 0.10 Mev. (auth)

394

DETERMINATION OF THE ALPHA-ENERGY OF U^{235}. R. Vestergaard and E. Haeffner. Arkiv Fysik 3, 557-75(1952). (In English)

The energy of the α particles from U^{235} has been determined by means of an ionization chamber connected to a linear amplifier and a 10-channel pulse amplitude analyzer. The value obtained of 3.393 ± 0.014 Mev was measured relative to the alpha energies of U^{234} and U^{238}. Experimental details are given. (auth)

395

EXCITED LEVELS IN Ti^{48}. Maurice M. Miller. Phys. Rev. 88, 516-17(1952) Nov. 1.

Excited levels of Ti^{48} have been investigated by means of the radioactive decays of V^{48} and of Sc^{48}. The intensity of a 2.29-Mev gamma transition in Ti^{48} relative to the total number of V^{48} and Sc^{48} disintegrations is found to be different for the two decays. This evidence that the 2.29-Mev transition in Ti^{48} is not a crossover is further substantiated by delayed-coincidence measurements and lifetime considerations. (auth)

396

MEASUREMENT OF NATURAL RADIOACTIVITY BACKGROUND. J. W. Healy. Nucleonics 10, No. 10, 14-19(1952) Oct.

A general summary is given of the problems and techniques of measuring natural radioactivity background in the air, water, and ground monitoring programs. Tables of maximum permissible limits (in terms of maximum permissible concentrations) for aerosols and drinking water are included. The build-up of the daughter products of radon and thoron on the collectors interferes with the aerosol measurements. Ground monitoring correlates with both air and water monitoring, the three main items being soil, vegetation, and as a final check on the other two, local animal life. 26 references. (L.M.T.)

397

NATURAL AIRBORNE RADIOACTIVITY AS INDEX OF ATMOSPHERIC STABILITY. Ralph G. Smith. Nucleonics 10, No. 10, 71(1952) Oct.

Daily sampling and activity measurements of atmospheric dust over a two-month period indicates a possible correlation between natural-airborne radioactivity and atmospheric stability. A suppression of activity was noted when snow covered the ground and an increase during periods of rainfall. (L.M.T.)

398

K/(L + M) INTERNAL CONVERSION RATIOS FOR M4 TRANSITIONS. G. A. Graves, L. M. Langer, and R. D. Moffat. Phys. Rev. 88, 344-8(1952) Oct. 15.

A high-resolution magnetic spectrometer has been used to study the internal conversion lines of magnetic four-pole transitions. The K/(L + M) internal-conversion ratios fall lower than those predicted from the empirical curve of Goldhaber and Sunyar (Phys. Rev. 83, 906(1951)) in the region of low values of Z^2/E_γ. A revised curve is presented. The following values are obtained for the energy of the transition and for the K/(L + M) ratio: Y^{91}, 551.2 kev, 6.00; Sr^{87}, 388.2 kev, 5.79; Y^{87}, 381.3 kev, 5.41; Ba^{137}, 661.4 kev, 4.64; In^{113}, 391.7 kev, 4.21; and In^{115}, 334.6 kev, 3.76. Values are also given for lines in Cd^{111} and In^{114}. (auth)

399

EXCITATION OF THE ELECTRON CORTEGE DURING α DECAY OF POLONIUM-210. Michel Riou. J. phys. radium 13, 487-8(1952) Oct. (In French)

The author recently (NSA 6-4257) attributed the Pb K and L x rays observed in Po^{210} decay to internal conversion of an 800-kev γ ray and α-particle excitation of Pb contamination. This interpretation has been disproved by the observations of De Benedetti and Minton (NSA 6-2527) and by analysis of the Po source for Pb. The emission of Pb x rays must arise in large part from excitation of the peripheral electrons by internal ionization during the α emission. This phenomenon should result in emission of electrons, which may explain the observations of Grace et al. (NSA 5-4605), and appearance of a low-energy α-ray side band, which would be difficult to observe. (G.Y.)

400

INTERVENTION OF THE ELECTRON CORTEGE IN α EMISSION. P. Benoist-Gueutal. J. phys. radium 13, 486-7 (1952) Oct. (In French)

During α emission, the peripheral electrons, independently of removal by collision with the α particle, must adapt themselves to a new coulomb field of the nucleus. If the α emission is sufficiently abrupt, the electrons will be left in excited states of the final nucleus (autoionization or autoexcitation). If the change of charge is sufficiently slow, the electrons adjust adiabatically, retaining their original quantum numbers. The condition for abrupt perturbation of an electron is found to be $(v/c)\,(1/E_n)\,(4 \times 137 \times 13.53/n^2) \gg 1$, where E_n is the energy of ionization in electron volts of the electron in its initial state characterized by the principal quantum number n. Applying this equation to Po^{210}, for which $v/c \approx 5.3 \times 10^{-2}$, the author shows that the first member of the inequality is <1 for K, L, M, and N electrons of Po. Only internal ionization by the α particle, therefore, is to be considered in explaining experimental results for any α emitters for which v/c is of the same order of magnitude. (G.Y.)

401

DEEXCITATION OF THE NUCLEUS BY POSITRON-NEGATRON PAIR PRODUCTION. Michel Riou. J. phys. radium 13, 480-4(1952) Oct. (In French)

The principal theoretical and experimental results on internal pair production are reviewed. These include probabilities, energy distributions, and angular distributions for the different electric and magnetic multipoles, as well as for the transitions $0 \rightarrow 0$, no (case of O^{16}). The phenomenon of internal pair creation with monoenergetic positrons is considered. (tr-auth)

402

THE K/L RATIO FOR THE 90-kev LINE OF Nd^{147}. Alan B. Smith and Allan C. G. Mitchell. Phys. Rev. 87, 1128-9 (1952) Sept. 15.

The spectrum of the electrons in the region of the internal conversion lines due to the 91-kev γ ray was examined by means of a magnetic-lens spectrograph. K, L, and M lines were resolved, and the K/L ratio was determined as 7.55. (L.M.T.)

403

DISINTEGRATION OF Cr^{51}. W. S. Lyon. Phys. Rev. 87, 1126(1952) Sept. 15.

The branching ratio of the Cr^{51} nuclide was investigated by coincidence counting, x-ray counting and NaI crystal spectrometry. Very little β^- or e^- was found associated with the decay; therefore the x rays observed were essentially all from orbital capture. The γ spectrum of the nuclide showed the presence of only one γ ray, of energy 0.32 Mev. Of the Cr^{51} disintegrations, 8% were found to proceed through the 0.32-Mev excited state. Five half-life determinations of Cr^{51} gave a value of 27.75 ± 0.3 days. (L.M.T.)

404

RADIOACTIVE DECAY OF INDIUM^{114}. M. W. Johns, C. D. Cox, R. J. Donnelly, and C. C. McMullen. Phys. Rev. 87, 1134-5(1952) Sept. 15.

β-spectrometric measurements seem to verify the proposed decay scheme of In^{114}, the essence of which may be stated thus: In the decay of In^{114} a 50-day isomeric transition from the 0.192 Mev level to the ground state is followed by a 72-sec β transition (96%) to the ground state of Sn^{114}. K-capture transition (3.5%) goes to the 1.28-Mev excited level of Cd^{114}, followed by cascade gammas of energy 0.722 and 0.556 Mev. If a 1.85-Mev γ ray exists, its intensity is less than 0.25 of that of the 1.3-Mev radiation. (L.M.T.)

405

ANGULAR CORRELATION OF GAMMA-RAYS IN Ti^{48}. P. S. Jastram and C. E. Whittle. Phys. Rev. 87, 1133-4 (1952) Sept. 15.

The angular correlation function has been determined for the cascaded γ rays of 1.32 and 0.99 Mev in Ti^{48}. The correlated γ rays were identified by verifying that they followed the 16-day half life of V^{48}. Results following experimental evidence are that the spins of the ground state and first two excited states of Ti^{48} are, respectively, 0,2,4; the parities of the two excited states may be anything except the combination odd, even, respectively; for both Sc^{48} and V^{48} the spin of the ground state is either 4 or 5. Decay schemes of Sc^{48} and V^{48} are given. (L.M.T.)

406

K-SHELL CONVERSION COEFFICIENT OF Ce^{141}. R. L. Heath. Phys. Rev. 87, 1132-3(1952) Sept. 15.

A value of $\alpha_K = 0.46 \pm 0.02$ has been determined for the K-shell internal conversion coefficient of the 141-kev γ transition in Ce^{141} by means of a NaI scintillation spectrometer. Theoretical K-shell conversion coefficients obtained by extrapolation of the values of Rose (Phys. Rev. 83, 79 (1951)) give for magnetic dipole radiation $\beta_1^K = 0.457$ and for electric quadrupole radiation $\alpha_2^K = 0.428$. (L.M.T.)

407

THE DISINTEGRATION OF Tm^{170}. R. L. Graham, J. L. Wolfson, and R. E. Bell. Can. J. Phys. 30, 459-75(1952) Sept.

The radiations from the decay of Tm^{170} (127-day) have been studied by means of a lens-type β-ray spectrometer, a scintillation spectrometer, short resolving time ($2\tau_0 = 2 \times 10^{-9}$ sec) coincidence counting techniques, and a pair of lens-type β-ray spectrometers placed end to end with coincidence counting of the focused radiations from a single source. A disintegration scheme is proposed which is consistent with the experimental results. Decay is found to be by negative β-ray emission; the spectrum consists of two components, one of maximum energy 968 ± 4 kev (76%) proceeding to the ground state of Yb^{170} and one of maximum energy 884 ± 4 kev (24%) to an excited state in Yb^{170} followed by emission of a γ ray or conversion electron to the ground state. The γ-ray transition in Yb^{170} is found to have an energy of 84.1 ± 0.1 kev, a half life of $(1.57 \pm 0.05) \times 10^{-9}$ sec, and conversion coefficients $\alpha_K = 1.60 \pm 0.15$, $\alpha_L = 4.1 \pm 0.5$, $\alpha_M = 1.2 \pm 0.2$ which show that it is electric quadrupole in character. Upper limits are given for decay by K capture, 0.3%, or positive β-ray emission, 0.01%, and also for the occurrence of other γ rays. (auth)

408

ON THE γ-RAY SPECTRUM OF Ra(B + C). G. N. Whyte. Can. J. Phys. 30, 442-9(1952) Sept.

Measurements of the transmission of Ra(B + C) (Pb^{214} + Bi^{214}) γ rays through Pb between 0 and 26 cm are described and compared with the transmissions predicted on the basis of a modified version of the γ-ray spectrum of Ellis and Aston and on the basis of the spectrum of Latyshev et al. Ellis and Aston's spectrum gives the better agreement. Both the relative and absolute values of the γ-ray intensities given by Ellis and Aston are revised in the light of more recent information. This revised spectrum leads to a predicted value of 0.84 r/hr at a meter for the γ-ray output of a gram of Ra and its equilibrium products in 0.5 mm of Pt, in good agreement with experiment. (auth)

409

SOME NUCLEAR DISINTEGRATIONS AND THE NUCLEAR SHELL THEORY. Evani Kondaiah. Arkiv Fysik 4, 85-157(1952). (In English)

Decay schemes and nuclear properties of ten radioisotopes were studied by β-spectrometer and coincidence techniques. The experiments are described in detail, and spins and parities are assigned on the basis of the nuclear shell theory. The isotopes studied are Ru^{103}, Rh^{103m}, Pd^{109}, Ag^{109m}, Ce^{141}, Ce^{143}, Pr^{143}, Nd^{147}, Pm^{149}, and Os^{193}. (L.T.W.)

410

INTERNAL CONVERSION; INVESTIGATION OF SOME EXCITED STATES OF HEAVY NUCLEI BY THEIR CONVERSION RADIATION. J. Teillac. Ann. phys. (12) 7, 396-450 (1952) May-June. (In French)

The electronic radiations of less than 100 kev energy of MsTh1 (Ra^{228}), Ac, Pa, and Io (Th^{230}) have been studied with a low-pressure cloud chamber. For MsTh1 and Ac these radiations are due to conversion of 30- and 37-kev γ rays, respectively; the β spectrum could not be analyzed. The analogy with RaD (Pb^{210}) is clarified. For Pa, evidence is presented for three new lines from conversion of 44- and 66-kev γ rays, in excellent agreement with data from the α fine structure. The conversion radiation of Io arises principally from a 68-kev γ. By the method of impregnation of nuclear emulsion sensitive to individual electron tracks, the conversion radiations of the α emitters UII (U^{234}), Pu^{239},

and Io were studied. UII has a fine-structure line at ~55 kev above the ground state with intensity ~30%. For Pu^{239} the electronic radiation results largely from deexcitation of the 50-kev level of U^{235}. A special study of the number of conversion electrons was made with coincidence counters; satisfactory agreement was obtained with experimental results concerning the γ and L radiations of the α fine structure. Finally, the different conversion coefficients actually known are compared with theoretical calculations; on the basis of Weisskopf's hypotheses it is generally possible to determine the nature and polarity of the emitted radiations. Several interesting transitions to be studied experimentally are noted. (tr-auth)

411

THE REACTION $Li^7(\alpha,\gamma)B^{11}$ AND STATES OF B^{11}. G. A. Jones and D. H. Wilkinson. Phys. Rev. 88, 423-4(1952) Oct. 15.

The γ-ray transitions for states in B^{11} at 8.93, 9.19, and 9.28 Mev from the $Li^7(\alpha,\gamma)B^{11}$ reaction have been studied. The probability of the mode of de-excitation, expected energies, and measured energies are given for the 12 γ rays detected, and various angular distribution and correlation measurements made. A decay scheme of B^{11} is given. (L.M.T.)

412

THE QUENCHING OF ORTHO-POSITRONIUM DECAY BY A MAGNETIC FIELD. John Wheatley and David Halliday. Phys. Rev. 88, 424(1952) Oct. 15.

The quenching of three-quantum annihilation from positronium was measured by observing the change in the triple coincidence rate with magnetic field. Positronium was formed in SF_6 gas in a chamber between the poles of a magnet, with the decay detected with three magnetically shielded NaI scintillation counters placed with their axes 120° apart in the plane perpendicular to the field. At a given pressure the ratio of the true triple coincidence rate at field H to that at H = 0 was measured. A quenching plot for an SF_6 density of 0.052 g/cm^3 is given. (L.M.T.)

413

NATURAL RADIOACTIVITY OF BISMUTH. W. Riezler and W. Porschen. Z. Naturforsch. a7, 634-5(1952) Sept. (In German)

Ilford C2 emulsion was saturated with a 4% aqueous solution of Bi ammonium citrate and maintained for 100 days in N_2. Tracks of 9 to 11 μ range are attributed to Bi^{209} α particles of 2.9 Mev average energy. The intensity suggests a half life of 2×10^{17} yr, the probable error being 40%. (G.Y.)

414

RADIOACTIVE DECAY OF TELLURIUM-131. Klaus Geiger. Z. Naturforsch. a7, 579-83(1952) Sept. (In German)

Telluric acid was irradiated with thermal neutrons, and the resulting activity was concentrated by a Szilard-Chalmers separation. The half life of Te^{131} was found to be 24.8 ± 0.5 min. A new γ ray was discovered. Absorption and coincidence measurements showed that the β decay of Te^{131} is complex and permitted the decay scheme to be established. Two β spectra with maximum energies 1.35 ± 0.1 and 2.0 ± 0.1 Mev and intensity ratio 4:5 are emitted, in addition to two γ lines of 0.16 and 0.7 Mev. The results are compared with predictions of the nuclear shell model. (tr-auth)

415

A FORMULATION OF BETA-DECAY THEORY FOR FORBIDDEN TRANSITIONS OF ARBITRARY ORDER. I. SELECTION RULES AND ENERGY SPECTRA. II. ANGULAR DISTRIBUTIONS. J. A. Spiers and R. J. Blin-Stoyle. Proc. Phys. Soc. (London) A65, 801-14(1952) Oct. 1.

The matrix elements of β-decay theory are expressed in a way which not only gives the β spectra and angular distributions for arbitrary degree of forbiddenness, but also yields very simply the selection rules appropriate to any type of interaction. Results for the energy spectra confirm those found by Greuling (Phys. Rev. 61, 568(1942)) by inspection. General equations (valid for arbitrary Z) are derived for the angular distributions of β emissions and electron-neutrino correlations. (G.Y.)

416

THE ANGULAR DISTRIBUTION OF γ-RADIATION FROM ALIGNED NUCLEI. N. R. Steenberg. Proc. Phys. Soc. (London) A65, 791-800(1952) Oct. 1.

The angular distribution of γ radiation from nuclei aligned at low temperature is given as a series of Legendre polynomials, $I(\theta) = 1 + \Sigma_K A_K(T)\, P_K(\cos\theta)$, the A_K being temperature dependent. The formulation is applicable to cascade processes of arbitrary multipole orders and nuclear spins. An approximation valid for low degrees of alignment is given, as is the angular distribution from completely aligned nuclei. Application is made to Co^{60}. (auth)

417

DECAY ENERGY OF Ti^{51}. L. Koester, H. Maier-Leibnitz, T. Mayer-Kuckuk, K. Schmeiser, and G. Schulze-Pillot. Z. Physik 133, 319-24(1952). (In German)

The decay of Ti^{51} was studied by β-particle absorption, β spectrometry, γ-ray scintillation measurements, and coincidence measurements. A γ ray of 0.32 Mev energy was found. An average of one γ quanta was emitted per β decay, and the γ energy per β decay was 0.35 Mev. The β spectrum is complex; the hardest portion is not in coincidence with γ radiation and has a maximum energy of 2.2 Mev with a possible error of ±0.1 Mev. This decay energy fits in the diagram of β-decay energies given by Jensen and Suess (Arkiv Fysik 3, 577(1951)) on the basis of the nuclear shell model; it is thus a confirmation of the magic number 28. (tr-auth)

418

THREE NEW NEUTRON DEFICIENT ISOTOPES OF YTTRIUM. Albert A. Caretto, Jr. and Edwin O. Wiig. J. Am. Chem. Soc. 74, 5235-7(1952) Oct. 20.

Bombardment of spectroscopically pure Y_2O_3 with 130- or 240-Mev protons for 1 or 2 hr in the Rochester 130-in. cyclotron resulted in Y^{82}, Y^{83}, and Y^{85} production. Since the Y gross decay curve was so complex, it was impossible to resolve the half lives of these new isotopes directly. Measurement of yield vs. isolation time for the daughter Sr isotopes gave the following half lives: Y^{82}, 70 ± 10 min; Y^{83}, 3.5 ± 0.5 hr; Y^{85}, 5 ± 1 hr. (G.Y.)

RARE EARTHS AND RARE-EARTH COMPOUNDS

419

Institute for Atomic Research, Iowa State Coll.

SOME MAGNETIC AND ELECTRICAL PROPERTIES OF GADOLINIUM, DYSPROSIUM, AND ERBIUM METALS, by S. Legvold, F. H. Spedding, F. Barson, and J. F. Elliott. Oct. 10, 1952. 9p. (ISC-282)

Preliminary work on measurements of the ferromagnetic properties of some of the rare-earth transition metals are discussed. Data on the Curie point and magnetization curves are presented for Gd. The electrical resistivities of Gd, Dy, and Er are plotted from room temperature down to 2.2°K to ascertain the temperatures at which anomalies in the properties of the metals occur. (C.R.)

420

VIBRATION STRUCTURE OF ELECTRON TRANSITIONS IN SINGLE CRYSTALS OF PRASEODYMIUM AND NEODYMIUM SALTS. A. M. Hellwege and K. H. Hellwege. Z. Physik 133, 174-91(1952). (In German)

Absorption spectra, photographed with high dispersion and polarized light at 14°K, of trigonal single crystals of (Pr or $Nd)_2Zn_3(NO_3)_{12}\cdot 24H_2O$ are discussed. One molecule per unit

cell with D_{3d} symmetry is assumed. The symmetry in the region of the absorbing Pr^{+3} and Nd^{+3} ions and therefore the general symmetry of electron and vibration systems, is, however, only C_{3v}. The lattice-vibration frequencies were determined, with the aid of line polarization and extinction rules, from the frequency separation between vibration lines and pure electron-transition lines. Forty-two lattice vibrations were identified. The 12 equivalent NO_3^- ions per cell form a system whose proper vibration results, by resonance splitting of the vibrations of the free ions, in eight (four degenerate, four fundamental) coupled vibrations of different frequencies. (tr-auth)

SPECTROSCOPY

421

Argonne National Lab.

SPECTRAL EMISSIVITIES OF GRAPHITE AND CARBON, by O. C. Simpson and R. J. Thorn. [nd] 57p. (ANL-4878)

The spectral emissivities of graphite and carbon have been determined at a wavelength of 0.653 μ in the temperature range of 1285 to 2035°K and have been found to be temperature dependent in accordance with a prediction from data relating reflectivity to resistivity. For polished graphite of high purity having a resistivity of about 1120 microhm-cm the value obtained is 0.78; the value obtained for a polished high-density graphite having a resistivity of 1740 microhm-cm is 0.78; and that for polished spectroscopic carbon having a resistivity of 5080 microhm-cm is 0.79. For unpolished graphite (i.e., a surface obtained by the cut of a lathe tool) the value may be as high as 0.92. If graphite is sublimed from a polished surface, the latter becomes roughened, so that the emissivity increases. In one particular experiment it attained a value of 0.90. (auth)

422

THE BETA-SPECTRUM OF He^6. C. S. Wu, B. M. Rustad, V. Perez-Mendez, and L. Lidofsky. Phys. Rev. 87, 1140-1 (1952) Sept. 15.

He^6 produced by the $Be^9(n,\alpha)$ reaction was not swept from the target chamber by ethyl alcohol vapor which was then frozen out in CO_2 and N_2 cold traps. The He^6 was concentrated by two successive oil diffusion pumps before reaching the spectrometer source chamber. The Kurie plot of the He^6 β spectrum is linear from its 3.50 ± 0.05-Mev end point to about 0.6 Mev. The end point together with $t_{1/2}$ = 0.823 sec yields an ft value of He^6 of 815 ± 70 sec. (L.M.T.)

423

NUCLEAR SPECTROSCOPY OF Ba^{131}. M. W. Elliott, L. S. Cheng, J. R. Haskins, and J. D. Kurbatov. Phys. Rev. 88, 263-5(1952) Oct. 15.

The spectra of Ba^{131} have been investigated in permanent magnet spectrographs, a solenoidal β spectrometer and a thin-lens gamma-spectrometer. Gamma-rays of 122, 214, 241, 370, and 494 kev have been confirmed. In the conversion-electron spectrum, there is indication of the existence of three low-energy gamma-rays: ~65, ~43, and ~108 kev. The K/L ratios, K-conversion coefficients and relative intensities have been estimated. (auth)

424

THE HYPERFINE STRUCTURE OF HYDROGEN AND DEUTERIUM. A. G. Prodell and P. Kusch. Phys. Rev. 88, 184-90(1952) Oct. 15.

The hyperfine structure separations, ν_H and ν_D, of the ground states of hydrogen and deuterium have been measured by the atomic beam magnetic resonance method. In both cases the determination depends essentially on a measurement with high precision of the frequency of a very nearly field independent line at weak fields and the measurement with reduced precision of the frequencies of one or more field dependent lines. The design of the apparatus and the conditions under which the experiment was performed were such as to permit the accumulation of a large body of significant data and the determination of precise values for the hfs separations by statistical analysis of the data. We find $\nu_H = 1420.4051 \pm 0.0002 \times 10^6$ sec^{-1}, $\nu_D = 327.38424 \pm 0.00008 \times 10^6$ sec^{-1}. From these results and the very accurately known ratio of the proton and deuteron magnetic moments, we find $\Delta = 1.703 \pm 0.008 \times 10^{-4}$, where $(\nu_H/\nu_D)_{exp} = (\nu_H/\nu_D)[1-\Delta]$ and (ν_H/ν_D) is calculated from the ratio of the magnetic moments of the proton and deuteron under the assumption that these particles are point dipoles which interact with the electronic magnetic field. (auth)

THEORETICAL PHYSICS

425

ITERATIVE PROCEDURES AND THE HELIUM WAVE EQUATION. James H. Bartlett. Phys. Rev. 88, 525-6 (1952) Nov. 1.

In an attempt to solve the helium wave equation exactly, study of a 180-point mesh shows the need for an improved difference operator to approximate the laplacian. Such an operator has been developed, allowing one to express the value of the function at one point in terms of the values at 26 neighboring points (in three dimensions). (auth)

426

THE IMPULSE APPROXIMATION AND FIELD THEORETICAL CALCULATIONS. I. John S. Blair and Benjamin Segall. Phys. Rev. 88, 621-24(1952) Nov. 1.

The reaction α + nucleus → β + nucleons is considered where α and β are particles of quantized fields and the coupling to nucleons is assumed linear in the fields. By an extension of the recent work of Chew and Goldberger (Phys. Rev. 87, 778(1952)) on potential scattering, the collision matrix has been manipulated into a term representing the impulse approximation plus three correction terms which are, respectively, the error in the impulse assumption arising from nuclear potentials, the "multiple scattering" which is at least fourth order in the coupling, and, finally, a small term representing the effect of lowest-order absorption. It is significant that there is no large term present, of the order of the impulse approximation term, which represents processes, second order in the coupling, where one nucleon absorbs α and another nucleon emits β. (auth)

427

DIFFRACTION IN TIME. Marcos Moshinsky. Phys. Rev. 88, 625-31(1952) Nov. 1.

In a previous note a dynamical description of resonance scattering was given, and transient terms appeared in the wave function describing the process. To understand the physical significance of these terms, the transient effects that appear when a shutter is opened are discussed in this paper. For a nonrelativistic beam of particles, the transient current has a close mathematical resemblance to the intensity of light in the Fresnel diffraction by a straight edge. This is the reason for calling the transient phenomena by the name of diffraction in time. The shutter problem is discussed for particles whose wave functions satisfy the Schroedinger equation, the ordinary wave equation, and the Klein-Gordon equation. Only for the Schroedinger time-dependent equation do the transient wave functions resemble the solutions that appear in Sommerfeld's theory of diffraction. The connection of transient phenomena with the time-energy uncertainty relation, and the interpretation of the transient current in a scattering process, are briefly discussed. The relativistic wave functions for the shutter problem may play an important role in the dynamical description of a relativistic scattering process. (auth)

428
RELATIVISTIC FOURIER RECIPROCITY AND THE ELEMENTARY MASSES. Erwin Schrödinger. Proc. Roy. Irish Acad. A55, No. 2, 2-50(1952).

Recent attempts to specify the equations controlling the field of an elementary particle suggest that the field be not of second or first order but that its operator be, in the simplest case of a scalar wave function, either a polynomial or transcendental function with only real positive roots. It was suggested to admit either only functions that are their own Fourier transforms or only eigenfunctions of a four-dimensional oscillator equation. This paper elucidates both suggestions, their relation, and possible alternatives. It is concluded that neither the demand of Fourier reciprocity nor the canonically reciprocal equation of Born appears to yield a sound mathematical basis for restricting the choice of the fundamental wave operators of quantum mechanics in the desired way that would imply definite values for the ratios of the rest masses of particles. (L.T.W.)

429
QUANTUM ELECTRODYNAMICS IN THE FORMULATION OF RECIPROCITY. I. Raĭskiĭ. Zhur. Eksptl'. i Teoret. Fiz. 22, 194-9(1952) Feb. (In Russian)

In accordance with Born's concept of nonlocalization and reciprocity (NSA 4-5549), which was further developed by Yukawa (NSA 4-1605), the author analyzes the nonlocal spinor field $\psi(X,r)$ depending on two types of variables X_μ and r_μ, assuming that this field is expressed by Dirac's equation in X_μ. (G. Y.)

430
SOME CONSEQUENCES OF INVARIANCE UNDER CHARGE CONJUGATION. L. Wolfenstein and D. G. Ravenhall. Phys. Rev. 88, 279-82(1952) Oct. 15.

The charge conjugation operator, which transforms charged fields to their charge-conjugate fields and reverses the sign of the electromagnetic field, is explicitly constructed. States of zero net charge are eigenstates of this operator; the eigenvalues are $(-1)^n$ for states of n photons and (+1) and (−1) for the singlet and triplet S states of positronium, respectively. The effect of charge conjugation on neutral boson fields is also discussed. Physical consequences of the invariance of field theory under this transformation include: (1) For usual interactions a spin-zero particle (including the singlet S state of positronium) cannot decay into three photons, although this decay is shown to be allowed by angular momentum and parity considerations. (2) The m = 1 and m = −1 levels of triplet positronium cannot be split by a magnetic field. (auth)

431
REMARKS ON SCALAR PAIR THEORIES. Gregor Wentzel. Helv. Phys. Acta 25, 569-76(1952) Sept. 15. (In German)

Scalar pair theory has new interest in that interaction terms of pair-theory type in the pseudoscalar Yukawa theory can be isolated by Dyson or Foldy transformations in such a way that the (pseudo) scalar pair theory can be applied as a "zero approximation" to the pseudoscalar Yukawa theory. The author has deduced this relation in order to develop earlier investigations on the saturation properties of nuclear forces. It is shown that the saturation, according to this theory, arises as a consequence of the many-body forces, whereas the exchange forces play a subordinate role. (tr-auth)

432
THEORY OF NUCLEAR SHELLS. Cl. Liesse. Bull. classe sci. Acad. roy. Belg. (5) 38, 176-81(1952). (In French)

The space of the nucleus is considered as a Riemannian space of three dimensions, whose metric is that of a hyperellipsoid of revolution about an axis perpendicular to the Euclidean space in which the nucleus is found. This model gives excellent correlation with Mayer's nuclear shell model. (tr-auth)

433
SPACE OF THE NUCLEUS AND SHELL STRUCTURE. J. Géhéniau. Bull. classe sci. Acad. roy. Belg. (5) 38, 71-7 (1952). (In French)

An attempt to relate the space of the nucleus to its properties is proposed. The author correlates the shells of Mayer's nuclear model with the properties of a "hemihyperellipsoidal" space. (tr-auth)

434
EQUIVALENT POTENTIALS. Res Jost and Walter Kohn. Phys. Rev. 88, 382-5(1952) Oct. 15.

An explicit construction is described for the entire class of potentials leading, for a particular angular momentum, to the same phase shift and energy spectrum as a given central potential. A similar procedure is applied to potentials with purely discrete spectra. (auth)

435
THE RYDBERG CONSTANT AND THE ATOMIC MASS OF THE ELECTRON. E. Richard Cohen. Phys. Rev. 88, 353-60(1952) Oct. 15.

A re-evaluation of the spectroscopic data pertinent to the Rydberg constant and the atomic mass of the electron yields the values $R_\infty = 109737.326 \pm 0.014\ cm^{-1}$ and $m = 54.895 \pm 0.008 \times 10^{-6}$ amu. If the "microwave" value of the electron atomic mass, $m = 54.8785 \pm 0.0019 \times 10^{-6}$, is used, the Rydberg constant is $R_\infty = 109737.311 \pm 0.012\ cm^{-1}$. It is furthermore concluded that Houston's (Phys. Rev. 30, 608 (1927)) and Chu's (Phys. Rev. 55, 175(1939)) data can be brought into agreement with that of Drinkwater, Richardson, and Williams (Proc. Roy. Soc. (London) 174, 164(1940)) by ascribing the discrepancy to differences in wavelength standards used by these investigators. (auth)

436
SPINOR FORMULATION OF BETA-DECAY AND SIMILAR INTERACTIONS. M. H. L. Pryce. Z. Physik 133, 309-18 (1952). (In English)

Transmutation processes in which four spin-½ particles take part, of which β decay is the best known example, are discussed. The possibility of a "universal" interaction between any four such particles is considered. If there is a universal interaction, it must be symmetrical in all four particles involved, taking due regard of the equivalence between creation of a particle and annihiliation of its antiparticle. A formalism that maintains the symmetry, and at the same time throws a different light on the classification of the various Lorentz-invariant interactions, is furnished by spinor calculus. No new results are derived, but the present derivation of known results may be suggestive when more experimental evidence becomes available. (G.Y.)

437
QUANTUM CORRECTIONS TO CLASSICAL NONLINEAR MESON THEORY. Donald R. Yennie. Phys. Rev. 88, 527-36(1952) Nov. 1.

For a linear Einstein-Bose field of large amplitude it is well known that the classical approximation is quite good for treating certain problems; the validity of this conclusion for the case of a nonlinear field is investigated here. In order to compare the classical and quantized versions of a nonlinear meson theory, we consider the problem of calculating the energy of interaction of the field with a given static source distribution. The quantized theory is treated in such a way that the classical result appears as a first approximation; the quantum corrections then include infinite renormalizations of the original parameters of the theory plus finite corrections to the energy. Part of these corrections are estimated and are found to become increasingly important with increasing source strength, contrary to the usual assumption. Since only a small part of the total quantum correction can be estimated by the present methods, a

complete calculation might give a value very much larger or very much smaller than that given here; nevertheless, it is possible to conclude that the nature of quantum corrections is such that they cannot be treated as small perturbations. (auth)

URANIUM AND URANIUM COMPOUNDS

438

Argonne National Lab.

THE THERMAL NEUTRON FISSION AND CAPTURE CROSS-SECTION OF U^{232}, by R. Elson, W. Bentley, A. Ghiorso, and Q. Van Winkle. June 10, 1952. Decl. Oct. 24, 1952. 3p. (AECD-3455; ANL-WMM-986)

Three samples of Pa^{231} were subjected to three different total neutron fluxes and the resulting U^{232} was examined for fissionability in the thermal column of the Argonne heavy-water pile. The rate of fission was compared with that of a given sample of Pu^{239} and the fission cross section of U^{232} determined from the known rate and cross section of the Pu^{239}. Results give a value of 83 ± 15 barns for the thermal neutron fission cross section. One sample examined for U^{233} formed by second order neutron capture indicated an error of only 0.5 barn from the amount present. A rough estimate of the pile neutron capture cross section of U^{232} indicated a value of ~200 barns. (L.M.T.)

439

Knolls Atomic Power Lab.

THERMAL CONDUCTIVITY, ELECTRICAL RESISTIVITY, AND THERMOELECTRIC POWER OF URANIUM, by W. W. Tyler, A. C. Wilson, Jr., and G. J. Wolga. Sept. 8, 1952. 25p. (KAPL-802)

Thermal conductivity, electrical resistivity, and thermoelectric power measurements have been made on a sample of normal U in the temperature range from 20 to 300°K. The thermal conductivity increases from 0.028 cal/cm-sec-°K at 20°K to 0.064 at 300°K. In the same temperature interval, the electrical resistivity varies from 4.0×10^{-6} to 29.2×10^{-6} ohm-cm. Throughout this temperature range, the Wiedemann-Franz ratio is near the free-electron theoretical value. The absolute thermoelectric power of U is positive, varying from approximately 2 microvolts/°K at 20°K to approximately 7.5 at 300°K. (auth)

PATENTS

CHEMISTRY

440

SELECTIVE ELECTRODEPOSITION OF SILVER. J. C. Griess, Jr. and L. B. Rogers (to U. S. Atomic Energy Commission). U. S. Patent 2,612,470. Sept. 30, 1952.

A process is described for selectively recovering silver by electrodeposition from an alkaline aqueous solution comprising trace amounts of silver along with macro quantities of palladium and containing a complex-forming substance, such as ammonium hydroxide, cyanides or the like, in an amount in excess of that required to solubilize the silver and palladium present.

441

URANIUM PURIFICATION AS COMPLEXES OF ESTERS OF TRIFLUORACETOACETIC ACID. H. I. Schlesinger and H. C. Brown (to U. S. Atomic Energy Commission). U. S. Patent 2,614,113. Oct. 14, 1952.

A method is described for separating uranium from commonly associated impurities which comprises treating an aqueous solution containing uranium values with an ester of trifluoroacetoacetic acid and separating the resulting uranium complex.

442

EXTRACTION OF CERIUM WITH AN ORGANIC SOLVENT. E. C. Pitzer (to U. S. Atomic Energy Commission). U. S. Patent 2,615,798. Oct. 28, 1952.

This process for the separation of cerium values from an aqueous solution containing cerium nitrate in a tracer concentration comprises incorporating an alkali metal dichromate to obtain a concentration of from 0.0004 to 0.01M, contacting the resultant aqueous solution with a substantially water-immiscible aliphatic ketone, and separating an aqueous phase and a ketone extract phase containing cerium values.

443

DISPOSAL OF RADIOACTIVE CATIONS. W. S. Ginell (to U. S. Atomic Energy Commission). U. S. Patent 2,616,847. Nov. 4, 1952.

This method of disposing of radioactive fission products in solution comprises bringing the solution into contact with a dried cation-exchange mineral consisting principally of montmorillonite, bentonite, and fuller's earth to adsorb radioactive fission products and these heating to a temperature in the range 705 to 1100°C and burying the heated clay.

ENGINEERING

444

WELDING DEVICE. R. W. Clack (to U. S. Atomic Energy Commission). U. S. Patent 2,613,305. Oct. 7, 1952.

A device is described for welding in an evacuated space by electron discharge between the parts to be welded and preferably multiplying the number of electrons by a resonant interchange of energy between the adjacent surfaces to be joined.

445

FLUID FLOW CONTROL SYSTEM. C. B. Graham (to U. S. Atomic Energy Commission). U. S. Patent 2,619,107. Nov. 25, 1952.

This system for automatically controlling the supply of a liquid medium, such as liquid nitrogen, to a cooling trap is responsive to the level of liquid in the trap. The motive power for actuating the device is supplied by the pressure of the vapor of the liquid medium being controlled.

PHYSICS

446

COMPENSATED THERMOCOUPLE. S. F. Mulford (to U. S. Atomic Energy Commission). U. S. Patent 2,612,779. Oct. 7, 1952.

This compensated thermocouple for measuring the temperature of a current-carrying conductor includes a meter and first and second dissimilar thermocouple wires connected to the meter and to each other at the hot juncture on the surface of the conductor, a third thermocouple wire of the same material as the first thermocouple wire connected to the hot juncture on the side of the second wire opposite from the first wire in the direction of current flow and to the first wire at a predetermined point, to form a balanced resistance bridge, whereby a potential impressed between the thermocouple wires at the hot juncture is cancelled.

447

MEGA VOLTMETER. C. E. Grunsky (to U. S. Atomic Energy Commission). U. S. Patent 2,613,235. Oct. 7, 1952.

A circuit is given for a vacuum tube voltmeter capable of accurately measuring the peak voltage of pulses having extremely short duration.

448

VOLTAGE MEASURING APPARATUS. H. Palevsky and R. K. Swank (to U. S. Atomic Energy Commission). U. S. Patent 2,613,236. October 7, 1952.

This ultrasensitive electrometer system for the measurement of small direct voltages from sources of very high im-

pedance and for the measurement of electrostatic charges includes a simple, sensitive, reliable and stable amplifying and metering system for use with dynamic condensers and a simple and reliable synchronous detector circuit.

449
DOSIMETER. A. O. Beckman, H. H. Herd, and A. D. Robinson (to U. S. Atomic Energy Commission). U. S. Patent 2,613,327. Oct. 7, 1952.

This pocket-size radiation dosimeter of the electroscope type is equipped with an improved lens arrangement for reading and has hermetically sealed and separate ionization and electroscope chambers and simplified charging means.

450
HIGH-VOLTAGE REGULATOR. W. H. Nelson (to U. S. Atomic Energy Commission). U. S. Patent 2,613,344. Oct. 7, 1952.

This patent covers an improved and simplified high voltage regulator having a series-connected lesser tube controlled by a negative feedback amplifier having a minimum phase shift around the regulator loop.

451
DIFFUSION MEASURING METER. C. G. Bacon (to U. S. Atomic Energy Commission). U. S. Patent 2,613,531. Oct. 14, 1952.

This apparatus and method for measuring the porosity of a substance comprises means for producing very low pressures on opposite sides of a sample of the substance, ion gages for measuring the pressures on opposite sides, and means including a volume manometer and a leak port for allowing measured volumes of a gas to diffuse through the sample, the rate of diffusion being measured against time.

452
APPARATUS FOR CHEMICAL REACTION DETECTION. H. A. Wilhelm (to U. S. Atomic Energy Commission). U. S. Patent 2,614,645. Oct. 21, 1952.

The progress of a chemical reaction within a sealed reaction chamber is followed by means of novel combination of devices for the detection of the sonic vibrations set up during the reaction.

453
CURRENT MEASURING DEVICE. C. J. Brown (to U. S. Atomic Energy Commission). U. S. Patent 2,615,063. Oct. 21, 1952.

This current measuring device and circuit measures minute electric currents such as the target current of an ion accelerator. The integrating circuit of the device includes a capacitor of selected size which is discharged upon accumulation therein of a selected charge. Each discharge represents a definite amount of integrated current and is recorded on a visible indicating recorder.

454
SYNCHRO-CYCLOTRON. E. M. McMillan (to U. S. Atomic Energy Commission). U. S. Patent 2,615,129. Oct. 21, 1952.

In this synchrocyclotron the frequency modulation of the resonant system depends directly upon the rotating mechanical vacuum capacitor capable of producing frequencies up to 2000 cps. By employing means to control the frequency of the oscillating electric field and varying the ratio of the frequency of the oscillation to the magnetic field strength, it is possible to accelerate deuterons to a final energy of 200 Mev.

455
MASS ANALYZING APPARATUS. W. E. Gleen, Jr. (to U. S. Atomic Energy Commission). U. S. Patent 2,615,135. Oct. 21, 1952.

This apparatus and method for rapidly and accurately determining the components of a mixture by mass analysis comprises means for producing controlled oscillation of the ion beam to separate and identify the ions of different masses and suitable ion producing and collecting means.

456
ATOMIC AIR BURST DIRECTION FINDER. G. A. Allard (to U. S. Atomic Energy Commission). U. S. Patent 2,615,249. Oct. 28, 1952.

Quick and easy location of the point of detonation of an atomic bomb in the air is achieved by providing an indicator which may be in the form of a truncated conical painted surface mounted on a standard and provided with azimuth and elevation markings. A rod arranged axially of the conical painted surface casts a shadow from radiant heat on the inner surface thereof, thus indicating the direction of the airburst.

457
TIME-DELAY RELAY TESTING DEVICE. C. B. Gould (to U. S. Atomic Energy Commission). U. S. Patent 2,615,967. Oct. 28, 1952.

This patent describes an improved circuit and means useful in determining the time delay of a time-delay relay.

458
STABILIZER ARRANGEMENT FOR CYCLOTRONS AND THE LIKE. R. R. Weeks (to U. S. Atomic Energy Commission). U. S. Patent 2,616,042. Oct. 28, 1952.

This circuit and device, useful in the stabilization and control of cyclotrons, provides for manual and automatic controls, whereby the operating resonance frequency of a cyclotron can be accurately controlled from a remote point while maintaining the required frequency stability and ground-reference balance of the dees.

459
FAST NEUTRON DOSIMETER. G. S. Hurst (to U. S. Atomic Energy Commission). U. S. Patent 2,616,052. Oct. 28, 1952.

A method and apparatus are described for measuring the fast-neutron dosage absorbed by cell tissue in the presence of gamma radiation by a counting-rate method. A proportional counter is provided comprising a hydrogenous solid wall of a predetermined composition and thickness and a hydrogenous filling gas. The composition and thickness of the wall, the length of the counter, and the composition and pressure of the gas are related in a particular, predetermined manner such that the counting response of the detector is a measure of the fast neutron dose to tissue.

460
METHOD AND APPARATUS FOR MEASURING BEAM CURRENT. M. G. Holloway (to U. S. Atomic Energy Commission). U. S. Patent 2,616,053. Oct. 28, 1952.

A method and apparatus are described for readily determining the beam current and energy in a particle accelerator such as a cyclotron.

461
COINCIDENCE CIRCUIT. L. F. Wouters (to U. S. Atomic Energy Commission). U. S. Patent 2,617,042. Nov. 4, 1952.

This coincidence circuit comprises a pair of photomultiplier tubes for impressing signals upon the deflecting plates of a cathode ray tube and means for indicating only the occurrence of pulses of equal phase and magnitude.

462
RADIATION DETECTOR CIRCUIT. B. L. Weller (to U. S. Atomic Energy Commission). U. S. Patent 2,617,946. Nov. 11, 1952.

This radiation measuring device includes an ion chamber having a central collecting electrode, a cylindrical electrode and a guard ring therebetween having a potential substantially equal to that of the collecting electrode, and an amplifier incorporating an inverse feedback circuit that increases the stability when used to measure small currents.

463

APPARATUS FOR SUPPLYING CHARGE MATERIAL TO MASS SPECTROMETER. V. L. Parsegian and C. M. Stevens (to U. S. Atomic Energy Commission). U. S. Patent 2,618,750. Nov. 18, 1952.

Means are described for rapidly and economically introducing nongaseous samples into the evacuated interior of a mass spectrometer without interrupting the vacuum of the spectrometer.

464

AUTOMATIC DRIFT CORRECTOR. Q. A. Kerns (to U. S. Atomic Energy Commission). U. S. Patent 2,619,552. Nov. 25, 1952.

A circuit is described for automatically correcting the drift voltages in a d-c amplifier. The circuit network provides for periodically sampling the drift voltage of the d-c amplifier and for developing and applying a voltage of proper phase to overcome the drift voltage.

465

ADJUSTABLE ELECTRODE SUPPORT. J. D. Reid (to U. S. Atomic Energy Commission). U. S. Patent 2,619,609. Nov. 25, 1952.

This electrode support permits adjustment along planes at right angles to each other and also permits rotational adjustment so that the slits of the electrode may be readily and accurately aligned with the ion slits of the ionizing chamber.

NEW NUCLEAR DATA

Summary of New Nuclear Data on Half Lives, Radiations, Relative Isotopic Abundances, Nuclear Moments, Neutron Cross Sections, Reaction Energies, and Masses.

Prepared by National Bureau of Standards Nuclear Data Group with the assistance of Readers.

National Bureau of Standards Group: K. Way, C. L. McGinnis, M. Wood, and K. Thew.

Leaders of groups in other laboratories which are assisting with the abstracting: G. Friedlander, G. Scharff-Goldhaber, Brookhaven National Laboratory; J. M. Hollander, University of California; C. S. Wu, Columbia University; P. Axel, University of Illinois; A. C. G. Mitchell, L. M. Langer, University of Indiana; J. R. Stehn, Knolls Atomic Power Laboratory; H. Pomerance, Oak Ridge National Laboratory; E. O. Wiig, R. W. Fink, University of Rochester; W. E. Meyerhof, Stanford University.

With this issue, Nuclear Science Abstracts begins its second year of collaboration with the Nuclear Data Group of the National Bureau of Standards and the readers assisting them in the preparation of nuclear data lists. A new format for the presentation of the data has been developed which it is hoped will be more flexible and easier to use. A few minor changes in policy have been made which are mentioned below.

In addition to the three quarterly cumulations which appeared in Nos. 6B, 12B, and 18B of Volume 6 (1952), an annual cumulation of the 1952 data, No. 24B, is being prepared which will be sent to the entire mailing list as soon as ready. Extra copies of this issue will be available.* This booklet will effectively constitute a new supplement to Nuclear Data, National Bureau of Standards Circular 499, and its three Supplements.** Its coverage of the data begins exactly where Supplement 3 left off.

New Policies. It was decided to try out the convenience of making the data lists in alternate issues of NSA cover "light" or "heavy" elements only. Provisionally a "light" element is defined as one with $Z \leq 39$ and a "heavy" element as one with $Z > 39$. For the next few months NSA nuclear data lists in odd-numbered issues will deal with "light" elements only and those in even-numbered issues with "heavy" elements only. Places to search for information on a particular nucleus will thus be cut in half.

Another change has been made in the reporting of cross sections. These are now collected in a separate list to be found at the end of the list of radiation data.

Abbreviations are the same as those listed in NSA 6, No. 18B and No. 24B with the few changes and additions listed below. The suggestion of Goldhaber of using ϵ to denote electron capture has been adopted. An attempt has been made to eliminate some of the confusion about

*Government Printing Office, Washington 25, D. C. $0.55.

**Government Printing Office. The price of $4.25 covers Circular 499 and the three supplements.

radiation intensities by using different symbols for per cent disintegrations and relative numbers. New types of experiments make abbreviations for parity and angular momentum necessary.

ϵ	electron capture
ϵ_K, ϵ_L	electron capture from K, L shell
%	% of disintegrations
†	relative numbers. When used in connection with γ rays, relative numbers of photons, not photons plus conversion electrons, are meant
+, −	even, odd parity
↓	angular momentum of particle absorbed into nucleus

$_{2}He^{5}_{3}$ Levels $He^4(n,n)$ $E_n = 4.14$ 1c
ground $P_{3/2}$
1.76 $P_{1/2}$

P.Huber, E.Baldinger, Helv. Phys. Acta 25, 435(1952).

$_{2}He^{6}_{4}$ τ **0.83^s** pc
$Li^6(n,p)$ $Li^7(n,d)$ $Be(n,\alpha)$

M.E.Battat, F.L.Ribe, Phys. Rev. 86, 159A (1952); 88, 156(1952).

$_{4}Be^{9}_{5}$ Levels Be(p,p) $E_p = 31.5$ scin
2.5 11.6
6.8

R.Britten, Phys. Rev. 88, 283(1952).

$_{4}Be^{10}_{6}$ Levels Be(d,p) $E_d = 3.49$ ppl
No states between g.s. and 3.37 level

F.Ajzenberg, Phys. Rev. 88, 298(1952).

$_{5}B^{10}_{5}$ Levels Be(d,n) $E_d = 3.39$ ppl
d,n(θ)

0	+	
0.72	+	5.58
1.75	+	5.93
2.15	+	6.12
3.53	+	6.38 −
4.78		6.58
double 5.14	−	6.77

Possible levels at 5.37, 5.72

F.Ajzenberg, Phys. Rev. 88, 298(1952); 87, 205A(1952); 82, 43 (1951).

$_{6}C^{12}_{6}$ Levels C(p,p) $E_p = 31.5$ scin
4.3 9.5
7.5 ? 11 - 17 unresolved group

R.Britten, Phys. Rev. 88, 283(1952).

$_{9}F^{18}_{9}$ Resonances $N(\alpha,p)O^{17}$ $E_\alpha = 5.30$ cc

1.02	2.48	3.54
1.58	2.74	3.80
1.96	3.04	4.06

M.C.Kavadeniz, Istanbul Üniv. Fen Fakült. Mecmuasi 17A, 1(1952).

$_{10}Ne^{22}_{12}$ Levels $F^{19}(\alpha,p)Ne^{22}$ $E_\alpha = 5.30$ ppl
0.57
1.34
2.84

E.Hjalmar, H.Slätis, Arkiv Fysik 4, 323(1952).

$_{11}Na^{24}_{13}$ γ **1.3679 ± 0.0010** $s_{1/2}$ $p_{3/2}$
2.7535 ± 0.0010

A.Hedgran, D.Lind, Arkiv Fysik 5, 177(1952).

γ (1.38) $\alpha_{pair} = 0.6 \times 10^{-4}$ E2 s1
(2.76) $\alpha_{pair} = 7.1 \times 10^{-4}$ E2

S.D.Bloom, Phys. Rev. 88, 312(1952); 87, 236A(1952); 87, 181(1952).

γ (1.38) $\alpha_{pair} = 3 \times 10^{-5}$ E2 s1
(2.76) $\alpha_{pair} = 8 \times 10^{-4}$ E2

H.Slätis, K.Siegbahn, Arkiv Fysik 4, 485(1952).

$_{12}Mg^{26}_{14}$ Levels $Na^{23}(\alpha,p)Mg^{26}$ $E_\alpha = 5.30$ ppl
0.40
1.72
2.72

E.Hjalmar, H.Slätis, Arkiv Fysik 4, 323(1952).

$_{17}Cl^{34}_{17}$ τ **32.5^m** S(p,n)

N.W.Hintz, N.F.Ramsey, Phys. Rev. 88, 191(1952).

$_{17}Cl^{36}_{19}$ d,p(θ); ↓ = 2 Cl(d,p) $E_d = 6.9$

J.S.King, W.C.Parkinson, Phys. Rev. 88, 141(1952).

$_{19}K^{40}_{21}$ ϵ/β^- **0.06** ms of A
Based on $\tau_{total} = 1.27 \times 10^{9y}$; assumption of 4 sample ages of 1.03×10^{9y}

A.K.Mousuf, Phys. Rev. 88, 150(1952).

$_{20}Ca^{40}_{20}$ Level Ca(p,p) $E_p = 7.7$ a
3.8

J.A.Harvey, Phys. Rev. 88, 162A(1952).

Ti Relative abundances $TiCl_4$; ms

A	46	47	48	49	50
%	7.87	7.25	73.9	5.56	5.43

H.C.Mattraw, C.F.Pachucki, AECU - 1903(1952); NSA 6, 2526(1952).

$_{22}Ti^{51}_{29}$ No long-lived Ti^{51} activity from Ti(th n),ms
Activity in Ti foil due to Ta^{182}, chem

W.Forsling, A.Ghosh, Arkiv Fysik 4, 331(1951).

$_{23}V^{50}_{27}$ I 6 para

C.Kikuchi, M.H.Sirvetz, V.W.Cohen, Phys. Rev. 88, 142(1952).

$_{23}V^{51}_{28}$ I 7/2 para

C.Kikuchi, M.H.Sirvetz, V.W.Cohen, Phys. Rev. 88, 142(1952).

$_{25}Mn^{56}_{31}$ γ 100† 1.81 $\alpha_{pair}=5.6\times10^{-4}$ E1 sl
100† 2.13 $\alpha_{pair}=4.6\times10^{-4}$ E2? pe^-

H.Slätis, K.Siegbahn, Arkiv Fysik 4, 485(1952).

$_{27}Co^{60}_{33}$ γ 0.059 $\alpha_K=35$ pc, scin
10.7^m

J.M.Kahn, ORNL-1089(1951).

5.2^y $(1.17\gamma)/(1.33\gamma)=0.98\pm0.04$ sπ Cpt

B.S.Dzhelepov et al, Doklady Akad. Nauk USSR 77, 233(1951); NSA 5, 6510(1951).

Ni Relative abundances Ni(CO)$_4$; ms

A	58	60	61	62	64
%	68.0	26.3	1.13	3.66	1.01

H.C.Mattraw, C.F.Pachucki, AECU-1903(1952); NSA 6, 2526(1952).

$_{29}Cu^{64}_{35}$ $\beta^+\gamma$? No $\beta^-\gamma$

S.Meric, Istanbul Üniv. Fen Fakült. Mecmuasi 16A, 51(1951).

$_{31}Ga^{72}_{42}$ γ 64† 2.491±0.002 s$\pi\sqrt{2}$ pe^-
100† 2.508±0.002

A.Hedgran, D.Lind, Arkiv Fysik 5, 177(1952).

$_{32}Ge^{75}_{43}$ τ_1 48^s $As^{75}(n,p)$ $Ge^{74}(n,\gamma)$
48^s γ 0.175 scin

A.B.Smith, R.S.Caird, A.C.G.Mitchell, Phys. Rev. 88, 150(1952).

$_{32}Ge^{77}_{45}$ β^- 15% 0.614 $Ge^{74}(n,\gamma)$; sl
82^m 85% 1.137
γ 0.265 sl pe^-,scin
0.406 sl ce^-,scin
0.572 sl Cpt,scin
No $(1.137\beta^-)(\gamma)$

A.B.Smith, R.S.Caird, A.C.G.Mitchell, Phys. Rev. 88, 150(1952).

$_{33}As^{76}_{43}$ β^- 3% 0.48 As(pile n); s$\pi\sqrt{2}$
12% 1.76
33% 2.40
52% 2.98 $\Delta I=2$, yes shape
γ 0.558 $\alpha_K=0.002$ ce^-

E.P.Tomlinson, S.L.Ridgway, Phys. Rev. 88, 170A(1952), verbal report.

$_{34}Se^{77}_{43}$ γ 0.16 Se(fast n); sl ce^-
17^s

J.Orring, Arkiv Fysik 4, 469(1952).

γ 0.13 Se(pile n); pc, scin

J.M.Kahn, ORNL-1089(1951).

$_{36}Kr^{85}_{49}$ β^- 85% 0.83 Kr(n,γ) U(n,f) ms; sl
4.4^h γ 85% 0.1486 $\alpha_K=0.041$ M1 ce^-
γ I.T. 15% 0.3050 K/LM=7
[β] [$e^-_K(0.15\gamma)$]

I.Bergström, Arkiv Fysik 5, 191(1952).

10^y β^- 0.666 $\Delta I=2$, yes shape sl
Kr(n,γ) U(n,f) ms

I.Bergström, Arkiv Fysik 5, 191(1952).

$_{36}Kr^{88}_{52}$ β^- 68% 0.52 U(n,f) ms; sl
12% 0.9 ?
20% 2.7 a$\beta\gamma$; sl
γ 0.028 K/LM=8
[$e^-_K(0.028\gamma)$] [$\sim0.5\beta$]; $e^-/\beta=0.085$

S.Thulin, Arkiv Fysik 4, 363(1952).

$_{37}Rb^{87}_{50}$ τ $\geq4.8\times10^{10}y$
No βe^- 4π counter

I.Bühnisch, E.Huster, W.Walcher, Naturwiss. 39, 379(1952).

$_{37}Rb^{88}_{51}$ τ 17.7^m d 2.7^hKr; sl
β^- 13% 2.5 $\Delta I=2$, yes shape
9% 3.6
78% 5.3

S.Thulin, Arkiv Fysik 4, 363(1952).

Neutron Cross Sections

Reaction	σ Type	Value	Energy	Ref.
H(n)	σ_t	0.686	14.1	52c1
	σ_t	0.074 - 0.0413	97 - 220	52m1
He(n)	σ_t	1.02	14.1	52c1
Li^6(n)	σ_t	1.39	14.1	52c1
Li^6(n,p)	$\sigma(0.83^s He)$	6.7 mb	14	52b1
Li^7(n)	σ_t	1.45	14.1	52c1
Li^7(n,d)	$\sigma(0.83^s He)$	9.8 mb	14	52b1
Be^9(n)	σ_t	1.53	14.1	52c1
Be^9(n,α)	$\sigma(0.83^s He)$	10 mb	14	52b1
B^{10}(n)	σ_t	1.47	14.1	52c1
B^{11}(n)	σ_t	1.40	14.1	52c1
C(n)	σ_t	1.82	14.1	52c1
	σ_t	0.502 - 0.297	97 - 220	52m1
N(n)	σ_t	1.58	14.1	52c1
F(n)	σ_t	1.70	14.1	52c1
Na(n)	σ_t	1.71	14.1	52c1
Mg(n)	σ_t	1.75	14.1	52c1
Al(n)	σ_t	1.73	14.1	52c1
Si(n)	σ_t	1.86	14.1	52c1
P(n)	σ_t	1.97	14.1	52c1
S(n)	σ_t	1.92	14.1	52c1
Cl(n)	σ_t	2.00	14.1	52c1
K(n)	σ_t	2.24	14.1	52c1
K^{39}(n)	σ_a	1.9	th	52p1
K^{40}(n)	σ_a	~65	th	52p1
K^{41}(n)	σ_a	1.2	th	52p1
Ca(n)	σ_t	2.19	14.1	52c1
Ti(n)	σ_t	2.28	14.1	52c1

Neutron Cross Sections

Reaction	σ Type	Value	Energy	Ref.
Cr(n)	σ_t	2.45	14.1	52c1
Mn(n)	σ_t	2.54	14.1	52c1
Fe(n)	σ_t	2.60	14.1	52c1
	σ_t	graph	1-3.2	52m2
Co(n)	σ_t	2.72	14.1	52c1
Ni(n)	σ_t	2.67	14.1	52c1
	σ_t	graph	1-3.2	52m2
Ni^{58}(n)	σ_a	4.2	th	52p1
Ni^{60}(n)	σ_a	2.5	th	52p1
Ni^{61}(n)	σ_a	2	th	52p1
Ni^{62}(n)	σ_a	15	th	52p1
Cu(n)	σ_t	graph	1-3.2	52m2
Zn(n)	σ_t	3.06	14.1	52c1
	σ_t	graph	1-3.2	52m2
Ga(n)	σ_t	3.19	14.1	52c1
Ga^{69}(n)	σ_a	2.0	th	52p1
Ga^{71}(n)	σ_a	4.9	th	52p1
Se(n)	σ_t	3.56	14.1	52c1
Se^{74}(n)	σ_a	50	th	52p1
Se^{76}(n)	σ_a	82	th	52p1
Se^{77}(n)	σ_a	40	th	52p1
Se^{78}(n)	σ_a	0.4	th	52p1
Se^{80}(n)	σ_a	0.59	th	52p1
Se^{82}(n)	σ_a	2	th	52p1
Br(n)	σ_t	3.52	14.1	52c1
Kr^{78}(n)	$\sigma(34^h Kr)$	1.6	th	52b2
Sr(n)	σ_t	3.68	14.1	52c1
Y(n)	σ_t	3.88	14.1	52c1

52b1 M.E.Battat, F.L.Ribe, Phys. Rev. 88, 156 and 159A (1952).

52b2 I.Bergström, Arkiv Fysik 5, 191(1952).

52c1 J.H.Coon, E.R.Graves, H.H.Barschall, Phys. Rev. 88, 562(1952).

52m1 G.R.Wott, G.L.Guernsey, B.K.Nelson, Phys. Rev. 88, 9 (1952).

52m2 D.W.Miller, R.K.Adair, C.K.Bockelman, S.E.Darden, Phys. Rev. 88, 83(1952).

52p1 H.Pomerance, Phys. Rev. 88, 412(1952). Most of the absorption cross sections (by the pile oscillator method) in this paper have already been reported in NSA or Nuclear Data and its Supplements. Only those values not previously listed are given here.

Ground State Q's

Reaction	Standard	Value	Energy	Meth
$O^{18}(p,\alpha)N^{15}$	$Be^9(d,\alpha)$	3.96 ± 0.04	0.850	s
	J.Seed, Phil. Mag. 42, 566(1951).			
$F^{19}(\alpha,p)Ne^{22}$		1.57	5.30	ppl
	E.Hjalmar, H.Slätis, Arkiv Fysik 4, 323(1952).			
$Na^{23}(\alpha,p)Mg^{26}$		1.55	5.30	ppl
	E.Hjalmar, H.Slätis, Arkiv Fysik 4, 323(1952).			
$Cl^{35}(d,p)Cl^{36}$		6.3	6.9	
	J.S.King, W.C.Parkinson, Phys. Rev. 88, 141(1952).			
$V^{51}(d,p)V^{52}$		6.25	3.80	a,pc
	D.C.Hoesterey, Science 114, 481(1952).			